

C R Y S T A L
P R O D U C T S

Crystal Devices Catalogue

'08.10

“QMEMS” EPSON TOYOCOM

In order to meet customer needs in a rapidly advancing digital, broadband and ubiquitous society, we are committed to offering products that are one step ahead of the market and a rank above the rest in quality. To achieve our goals, we follow a “3D (three device) strategy” designed to drive both horizontal and vertical growth. We will to grow our three device categories of “Timing Devices”, “Sensing Devices” and “Optical Devices”, and expand vertical growth through a combination of products from these categories.

A Quartz MEMS is any high added value quartz device that exploits the characteristics of quartz crystal material but that is produced using MEMS (micro-electro-mechanical system) processing technology.

Market needs are advancing faster than previously imagined toward smaller, more stable crystal products, but we will stay ahead of the curve by rolling out products that exceed market speed and quality requirements. We want to further accelerate the 3D strategy by QMEMS.

Quartz devices have become crucial in the network environment where products are increasingly intended for broadband, ubiquitous applications and where various types of terminals can transfer information almost immediately via LAN and WAN on a global scale. Epson Toyocom Corporation addresses every single aspect within a network environment. The new corporation offers “Digital Convergence” solutions to problems arising with products for consumer use, such as, core network systems and automotive systems.



PROMOTION OF ENVIRONMENTAL MANAGEMENT SYSTEM CONFORMING TO INTERNATIONAL STANDARDS

At Epson Toyocom, all environmental initiatives operate under the Plan-Do-Check-Action(PDCA) cycle designed to achieve continuous improvements. The environmental management system (EMS) operates under the ISO 14001 environmental management standard.

All of our major manufacturing and non-manufacturing sites, in Japan and overseas, completed the acquisition of ISO 14001 certification. In the future, new group companies will be expected to acquire the certification around the third year of operations.

ISO 14000 is an international standard for environmental management that was established by the International Standards Organization in 1996 against the background of growing concern regarding global warming, destruction of the ozone layer and global deforestation.




WORKING FOR HIGH QUALITY

In order to provide high quality and reliable products and services than meet customer needs, Epson Toyocom made early efforts towards obtaining ISO9000 series certification and has acquired ISO9001 for all business establishments in Japan and abroad. We have also acquired ISO/TS 16949 certification that is requested strongly by major automotive manufacturers as standard.

QS-9000 is an enhanced standard for quality assurance systems formulated by leading U.S. automobile manufacturers based on the international ISO 9000 series.

ISO/TS 16949 is a global standard based on QS-9000, a severe standard corresponding to the requirements from the automobile industry.

► Explanation of the mark that are using it for the catalog

	<ul style="list-style-type: none">► Pb free.► Complies with EU RoHS directive.
	<ul style="list-style-type: none">► Pb free terminal designed. Contains Pb in products exempted by RoHS directive. (Contains Pb in sealing glass, high melting temperature type solder or other.)► Complies with EU RoHS directive.
	<ul style="list-style-type: none">► The products have been designed for high reliability applications such as Automotive.

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- These products are intended for general use in electronic equipment. When using them in specific applications that require extremely high reliability, such as the applications stated below, you must obtain permission from Epson Toyocom in advance.
 - / Space equipment (artificial satellites, rockets, etc.) / Transportation vehicles and related (automobiles, aircraft, trains, vessels, etc.)
 - / Medical instruments to sustain life / Submarine transmitters / Power stations and related / Fire work equipment and security equipment
 - / traffic control equipment / and others requiring equivalent reliability.
- In this new crystal master for Epson Toyocom, product codes and markings will remain as previously identified prior to the merger. Due to the on-going strategy of gradual unification of part numbers, please review product codes and markings, as they will change during the course of the coming months.

We apologize for the inconvenience, but we will eventually have a unified part numbering system for Epson Toyocom that will be user friendly.

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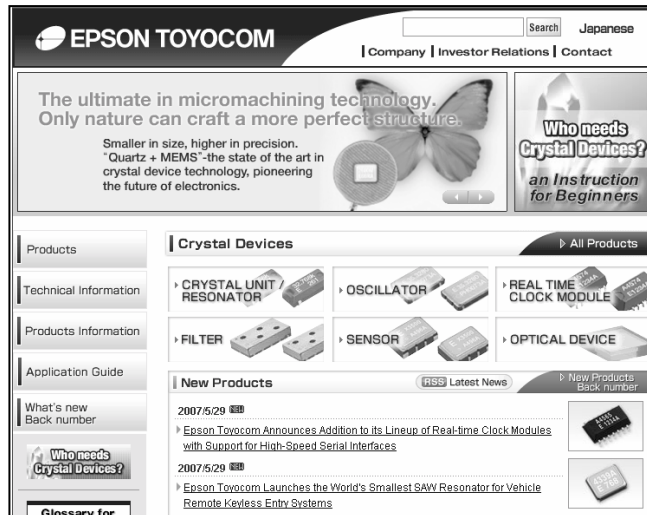


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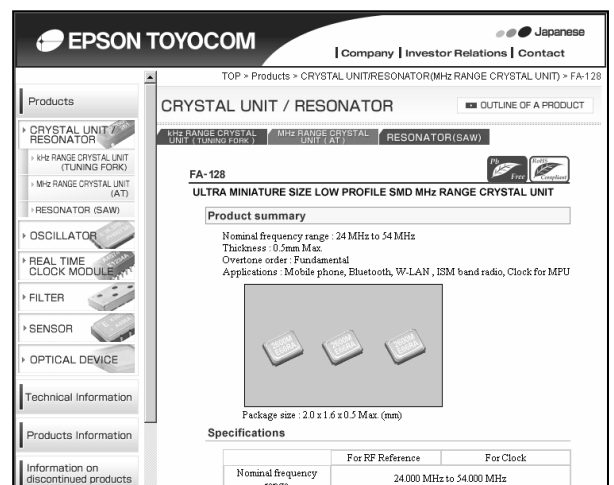
Epson toyocom is providing the Products Information, timing device, sensing device, optical device and more.
Please access here !

Epson Toyocom Home Page

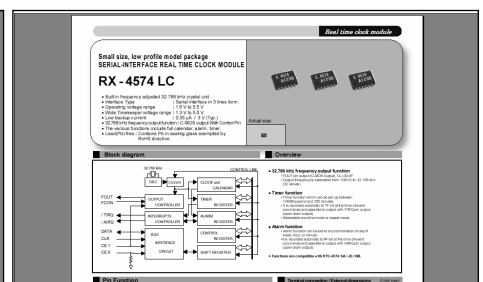
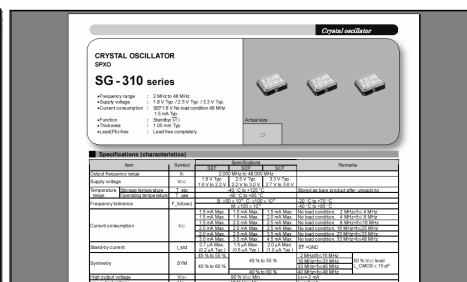
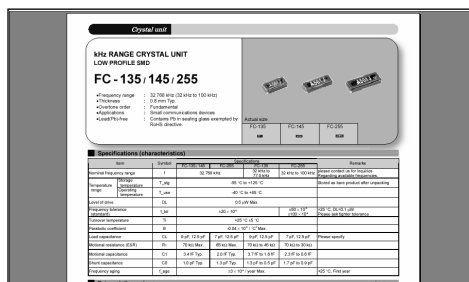
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Lineup Page for each device



Data Sheet page



Product Inquiry by E-Mail

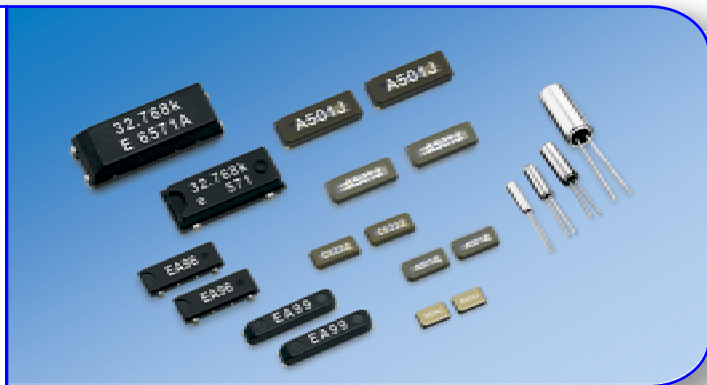
Epson Toyocom receives your inquiries on the products through e-mail.



kHz Range Crystal Unit

Features

- ▶ Photolithography finished allows uniform and stable performance.
- ▶ Many product lineups to an ultra small size SMD type and cylinder type.



kHz Range Crystal Unit (Tuning fork)

Model		Actual size (mm) Max.		Frequency					
				20 kHz	32 kHz	100 kHz	200 kHz	300 kHz	
	FC-12M		2.05×1.2×0.6 t		32 kHz	77.5 kHz			
	FC-125		2.05×1.2×0.7 t		● 32.768 kHz				
	FC-13E		3.2×1.5×0.48 t		● 32.768 kHz				
	FC-13F		3.2×1.5×0.6 t		● 32.768 kHz				
	FC-135		3.2×1.5×0.9 t	32 kHz	77.5 kHz				
	FC-145		4.1×1.5×0.9 t		● 32.768 kHz				
	FC-255		4.9×1.8×0.9 t						
	MC-146		7.0×1.5×1.4 t	32 kHz	100 kHz				
	MC-156		7.1×3.3×1.5 t						
	MC-306		8.0×3.8×2.54 t	20 kHz	165 kHz				
	MC-405/406		10.41×4.06×3.6 t	20 kHz	165 kHz			● 307.2 kHz	
	MC-30A		8.0×3.8×2.54 t	20 kHz	165 kHz				
	C-001R		Φ3.1						
	C-002RX		Φ2.0						
	C-004R		Φ1.5		● 32.768 kHz				
	C-005R		Φ1.2						
	C-2-TYPE		Φ2.0	20 kHz	165 kHz			● 307.2 kHz	
	C-4-TYPE		Φ1.5		32 kHz	120 kHz	● 192 kHz		

Specification (32.768 kHz)

Item	Nominal frequency	Frequency tolerance (Standard)	Frequency versus temperature characteristics	Motional resistance (Max.)	Load capacitance (Standard)	Storage temperature	Operating temperature
Model	f_nom	f_tol	Turnover temperature(Ti): +25 °C Typ.	R1	CL	T_stg	T_use
FC-12M	32.768 kHz	$\pm 30 \times 10^{-6}, \pm 50 \times 10^{-6}$	Parabolic coefficient(B): -0.04 $\times 10^{-6}$ / °C Max. f_tem =B (Ti-θx) ²	90 kΩ	12.5 pF	-55 °C to +125 °C	-40 °C to +85 °C
FC-125		$\pm 10 \times 10^{-6}, \pm 20 \times 10^{-6}$		90 kΩ	12.5 pF		
FC-13E		$\pm 100 \times 10^{-6}$		75 kΩ	9 pF, 12.5 pF		
FC-13F		$\pm 20 \times 10^{-6}$		80 kΩ	7 pF,		
FC-135				70 kΩ	9 pF,		
FC-145				70 kΩ	12.5 pF		
FC-255				$\pm 20 \times 10^{-6}$	65 kΩ		
MC-146		$\pm 20 \times 10^{-6}, \pm 50 \times 10^{-6}$		65 kΩ	7 pF, 9 pF, 12.5 pF		
MC-156				50 kΩ	12.5 pF		
MC-306							
MC-30A							
MC-405							
MC-406		$\pm 20 \times 10^{-6}$		35 kΩ 50 kΩ, 60 kΩ 50 kΩ 50 kΩ	6 pF to ∞	-20 °C to +70 °C	-10 °C to +60 °C
C-001R							
C-002RX							
C-004R							
C-005R							

Specification (kHz RANGE)

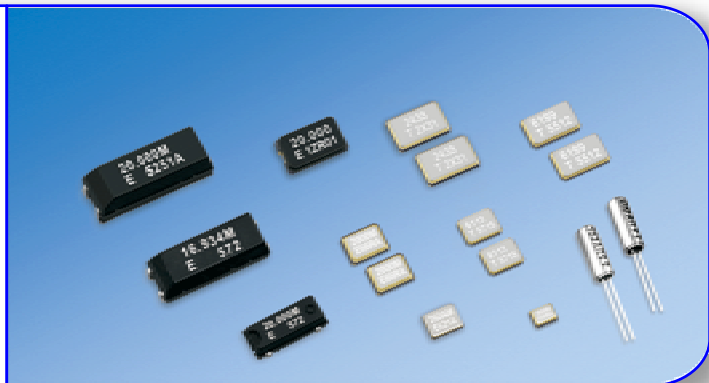
Item	Nominal frequency range	Frequency tolerance (Standard)	Frequency versus temperature characteristics	Motional resistance (Max.)	Load capacitance (Standard)	Storage temperature	Operating temperature	
Model	f_nom	f_tol	Turnover temperature(Ti): +25 °C Typ.	R1	CL	T_stg	T_use	
FC-12M	32 kHz to 77.5 kHz	$\pm 30 \times 10^{-6}, \pm 50 \times 10^{-6}$	Parabolic coefficient(B): $-0.04 \times 10^{-6} / ^\circ\text{C}$ Max. $f_{\text{tem}} = B (Ti - \theta x)^2$	65 kΩ to 90 kΩ	12.5 pF	-55 °C to +125 °C	-40 °C to +85 °C	
FC-135		$\pm 20 \times 10^{-6}$		45 kΩ to 70 kΩ	7 pF, 9 pF, 12.5 pF			
FC-255		$\pm 20 \times 10^{-6}$		30 kΩ to 70 kΩ	7 pF, 12.5 pF			
MC-146	32 kHz to 100 kHz	$\pm 50 \times 10^{-6}, \pm 100 \times 10^{-6}$		25 kΩ to 65 kΩ	7 pF, 9 pF, 12.5 pF			
MC-156								
MC-306	20 kHz to 165 kHz			6 kΩ to 55 kΩ	12.5 pF			
MC-30A				10 kΩ to 55 kΩ				
MC-405	20 kHz to 165 kHz, 307.2 kHz			6 kΩ to 55 kΩ				
MC-406								
C-2-TYPE	20 kHz to 165 kHz, 307.2 kHz	$\pm 20 \times 10^{-6}, \pm 50 \times 10^{-6}, \pm 100 \times 10^{-6}$		6 kΩ to 55 kΩ	6 pF to ∞	-20°C to +70 °C	-10 °C to +60 °C	
C-4-TYPE	32 kHz to 120 kHz, 192 kHz	$\pm 50 \times 10^{-6}, \pm 100 \times 10^{-6}$		10 kΩ to 55 kΩ				


















MHz Range Crystal Unit



Features

- ▶ The most popular AT cut crystal units.
- ▶ Miniaturization is materialized with the processing method that be unique.



■MHz Range Crystal Unit (AT)

Model		Actual size (mm) Max.		Frequency	1 MHz	10 MHz	20 MHz	64 MHz
	FA-128		2.0×1.6×0.5 t				24 MHz	54 MHz
	FA-20H		2.5×2.0×0.55 t			12 MHz		48 MHz ● 50 MHz, 52 MHz
	FA-238V		3.2×2.5×0.7 t			12 MHz	15.999 MHz	
	FA-238		3.2×2.5×0.7 t				16 MHz	60 MHz
	FA-23A		3.2×2.5×0.8 t			12 MHz		54 MHz
	TSX-3225		3.2×2.5×0.6 t				16 MHz	48 MHz
	TSX-4025		4.0×2.5×0.7 t			12 MHz		32 MHz
	TSX-5032		5.0×3.2×0.8 t			10 MHz		32 MHz
	FA-365		6.0×3.5×1.4 t				● 12 MHz 14 MHz	41 MHz
	MA-306		8.0×3.8×2.54 t				● 14.31818 MHz 17.734 MHz	41 MHz
	MA-406		11.7×4.8×3.7 t		4 MHz			64 MHz*
	MA-505/506		13.46×5.08×4.6 t		* 8.0 MHz < f < 8.2 MHz : Unavailable. Available frequency from 4 MHz to less than 5.5 MHz (4 MHz, 4.032 MHz, 4.096 MHz, 4.19 MHz, 4.194304 MHz, 4.433619 MHz, 4.5 MHz, 4.8 MHz, 4.9152 MHz)			
	CA-301		Φ3.1					

Model		Actual size (mm)		Frequency	50 MHz	100 MHz	200 MHz	500 MHz
	FH-33H		3.8×3.8×1.0 t (Max.)		60 MHz		230 MHz	

▶ Specifications

Specifications

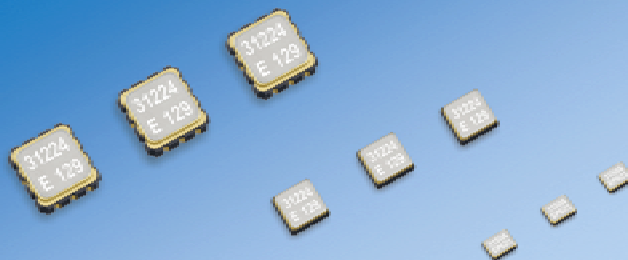
Item Model	Nominal frequency range	Frequency tolerance (Standard)	Frequency versus temperature characteristics (Operating temperature)	Motional resistance (Max.)	Load capacitance (Standard)	Storage temperature	Operating temperature
	f	f_tol	f_tem	R1	CL	T_stg	T_use
FA-128	24 MHz to 54 MHz	±10×10 ⁻⁶ ,±30×10 ⁻⁶	±10 × 10 ⁻⁶ ,±30 × 10 ⁻⁶ (-20 °C to +75 °C)	60 Ω to 80 Ω	8 pF to ∞	-40 °C to +125 °C	-40 °C to +85 °C
FA-20H	12 MHz to 48 MHz 50 MHz,52 MHz	±10×10 ⁻⁶ ,±30×10 ⁻⁶	±10 × 10 ⁻⁶ ,±30 × 10 ⁻⁶ (-20 °C to +75 °C)	40 Ω to 150 Ω	9 ,10,12,16 pF,∞	-40 °C to +125 °C	-40 °C to +85 °C
FA-238V	12 MHz to 15.999 MHz	±50×10 ⁻⁶	±30 × 10 ⁻⁶ (-20 °C to +70 °C)	80 Ω to 100 Ω	10 pF	-40 °C to +125 °C	-40 °C to +85 °C
FA-238	16 MHz to 60 MHz	±50×10 ⁻⁶	±30 × 10 ⁻⁶ (-20 °C to +70 °C)	40 Ω to 80 Ω	10 pF	-40 °C to +125 °C	-40 °C to +85 °C
FA-23A	12 MHz to 54 MHz	±10×10 ⁻⁶ ,±20×10 ⁻⁶	±20 × 10 ⁻⁶ (-40 °C to +85 °C) ±50 × 10 ⁻⁶ (-40 °C to +125 °C)	40 Ω to 200 Ω	9,12,16 pF, ∞	-40 °C to +125 °C	-40 °C to +125 °C
TSX-3225	16 MHz to 48 MHz	±10×10 ⁻⁶	±10×10 ⁻⁶ (-20 °C to +75 °C)	40 Ω to 60 Ω	9,12,16 pF, ∞	-40 °C to +125 °C	-20 °C to +75 °C
TSX-4025	12 MHz to 32 MHz						
TSX-5032	10 MHz to 32 MHz						
FA-365	12MHz,14 MHz to 41 MHz	±50×10 ⁻⁶ ,±100×10 ⁻⁶	±30 × 10 ⁻⁶ (-20 °C to +70 °C)	50 Ω to 60 Ω	10 pF to ∞	-55 °C to +125 °C	-20 °C to +70 °C
MA-306	14.31818 MHz, 17.734 MHz to 41 MHz	±50×10 ⁻⁶	±30 × 10 ⁻⁶ (-20 °C to +70 °C)	60 Ω		-55 °C to +100 °C	-20 °C to +70 °C
MA-406	4 MHz to 64 MHz		±30 × 10 ⁻⁶ ,±50 × 10 ⁻⁶ (-20 °C to +70 °C)	40 Ω to 150 Ω	Fundamental: 10 pF to ∞ 3ed Overtone: 5 pF to ∞	-55 °C to +125 °C	
MA-505 MA-506	4 MHz to 64 MHz					-40 °C to +85 °C	
CA-301	4 MHz to 64 MHz					±30×10 ⁻⁶ (±50×10 ⁻⁶ ,±100×10 ⁻⁶)	
FH-33H	60 MHz to 230 MHz	±35×10 ⁻⁶	±20 × 10 ⁻⁶ (-40 °C to +85 °C)	30 Ω to 40 Ω	17 pF to ∞	-50 °C to +95 °C	-40 °C to +85 °C













SAW Resonator

•Features

- ▶ Crystal resonator with surface acoustic wave.
- ▶ Photolithography finished allows uniform and stable performance.



■Resonator (SAW)

Model	Actual size (mm) Typ.	Frequency			
		200 MHz	500 MHz	700 MHz	1 GHz
 NS-21R	 2.5×2.0×0.86 t	300 MHz	500 MHz		
 NS-32R	 3.8×3.8×0.98 t	312 MHz	870 MHz		
 FS-335	 3.8×3.8×0.98 t	300 MHz	870 MHz		
 FS-555	 4.8×5.2×1.5 t	230 MHz	500 MHz		
 FS-585	 4.8×5.2×1.5 t	300 MHz	500 MHz		

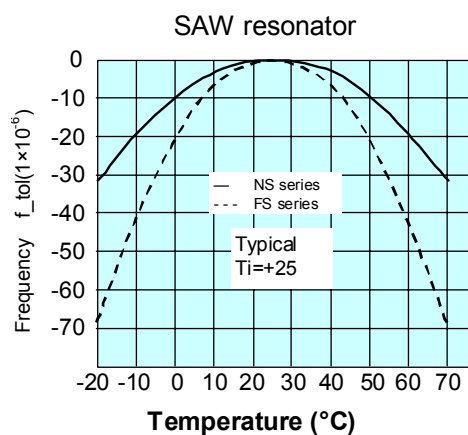
▶ Specifications

Item Model	Nominal frequency range	Frequency tolerance (Standard)	Frequency versus temperature characteristics	Motional resistance (Max.)	Harmonic ratio (standard)	Storage temperature	Operating temperature
	f _{nom}	f _{tol}	Parabolic coefficient (B)	R ₁	RS / R ₁	T _{stg}	T _{use}
NS-21R	300 MHz to 500 MHz	±50×10 ⁻⁶ ,±100×10 ⁻⁶ ,±150×10 ⁻⁶	-(1.6±0.4) ×10 ⁻⁸ / °C ²	20 Ω	2 Min.	-40 °C to +85 °C	-40 °C to +85 °C
NS-32R	312 MHz to 870 MHz	±50×10 ⁻⁶ ±100×10 ⁻⁶	-(1.6±0.4) ×10 ⁻⁸ / °C ²	30 Ω			
FS-335	300 MHz to 870 MHz	±50×10 ⁻⁶ ±100×10 ⁻⁶	-(3.4±0.8) ×10 ⁻⁸ / °C ²	25 Ω to 40 Ω			
FS-555	230 MHz to 500 MHz						
FS-585	300 MHz to 500 MHz	±50×10 ⁻⁶ ,±100×10 ⁻⁶	-(3.4+0.8) ×10 ⁻⁸ / °C ² -(3.4-0.6) ×10 ⁻⁸ / °C ²	18 Ω		-40 °C to +125 °C	-40 °C to +120 °C

Bits of knowledge

The temperature characteristic of the SAW resonator becomes the quadratic curve. It is the same temperature characteristic as a tuning fork crystal unit.

The inclination of the curve changes by the thickness and width of the electrode. The SAW resonator needs the advanced design for the electrode pattern. The SAW resonator (NS series) of Epson Toyocom optimizes design conditions and provides a higher temperature characteristic.



SAW resonator of temperature characteristic.

Use the approximate expression on calculation. $f_{tem} = B(Ti - \theta X)^2$

B : Parabolic coefficient $-(1.6 \pm 0.4) \times 10^{-8} / ^\circ\text{C}^2$
 $\rightarrow -0.02 \times 10^{-6} / ^\circ\text{C}^2$ Max.

Ti : Turnover temperature (+25 °C)

θX : Specified temperature (example : +50 °C)

$-0.02 \times (25 - 50)^2 = -12.5 \times 10^{-6}$
 (Temperature characteristic of 50°C become -12.5×10^{-6})

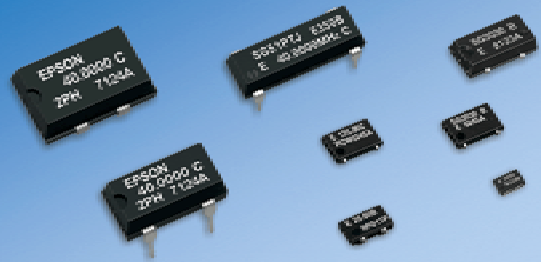


CRYSTAL OSCILLATOR

SPXO (Plastic package type)

Features

- ▶ Built-in heat resistive crystal unit provides heat resistance equivalent to that of general-purpose ICs.
- ▶ Low current consumption by output enable function (OE) or standby function ($\overline{\text{ST}}$).



SPXO Plastic package type

Model		Actual size (mm)		Frequency					
				1 Hz	1 MHz	50 MHz	100 MHz	500 MHz	800 MHz
	SG-3030JC SG-3040JC		10.5×5.8×2.7 t (Max.)	● 32.768 kHz					
	SG-3030JF		7.1×5.1×1.5 t (Max.)						
	SG-3030LC SG-3040LC		3.6×2.8×1.2 t (Max.)						
	SG-150 series		2.1×1.7×0.75 t (Typ.)	3 MHz		54 MHz			
	SG-550 series		5.0×3.2×1.2 t (Max.)	2 MHz		48 MHz			
	SG-645 series		7.1×5.1×1.5 t (Max.)	32.001 MHz			135 MHz		
	SG-636 series		10.5×5.8×2.7 t (Max.)	2.21675 MHz			135 MHz		
	SG-615 series		14.0×9.8×4.7 t (Max.)	1.025 MHz			135 MHz		
	SG-531 series		DIP half size						
	SG-51 series		DIP full size	1.025 MHz		66.667 MHz			

Specifications

Model	Item	Output frequency range	Frequency tolerance (Temperature range)	Operating temperature	Current consumption	Supply voltage	Output load condition	Output control
SG-3030LC/JF/JC		32.768 kHz	5±23 × 10 ⁻⁶	-40 °C to +85 °C	2 μA Max.	1.5 V to 5.5 V	15 pF	VIO
SG-3040LC/JC				-40 °C to +85 °C	3.1 μA Max.	0.9 V to 3.6 V		VIO
SG-150 SEE		3 MHz to 54 MHz	±15 × 10 ⁻⁶ ±20 × 10 ⁻⁶	-20 °C to +70 °C	4.5 mA Max.	1.6 V to 2.2 V	15 pF	ST
SG-150 SDE				-40 °C to +85 °C	5 mA Max.	2.25 V to 2.7 V		
SG-150 SCE				6 mA Max.	2.7 V to 3.6 V			
SG-550 SEF		2 MHz to 48 MHz	±50 × 10 ⁻⁶ ±100 × 10 ⁻⁶	-20 °C to +70 °C	3 mA Max.	1.6 V to 2.2 V	15 pF	ST
SG-550SDF				-40 °C to +85 °C	3.5 mA Max.	2.2 V to 3.0 V		
SG-550SCF				-40 °C to +85 °C	4.5 mA Max.	2.7 V to 3.6 V		
SG-645PTW/STW		32.001 MHz to 135 MHz	±50, ±100 × 10 ⁻⁶ (-20 °C to +70 °C) ±100 × 10 ⁻⁶ (-40 °C to +85 °C)	-20 °C to +70 °C (-40 °C to +85 °C)	45 mA Max.	4.5 V to 5.5 V	5 TTL	OE/ ST
SG-645PHW/SHW					15 pF			
SG-645PCW/SCW					28 mA Max.	3.0 V to 3.6 V	15 pF	
SG-636PTF	2.21675 MHz to 41 MHz	±100 × 10 ⁻⁶	-20 °C to +70 °C	17 mA Max.	5.0 V±0.5 V	10 TTL, 50 pF	OE	
SG-636PH	41.001 MHz to 70 MHz			35 mA Max.		15 pF		
SG-636PCE/SCE	2.21675 MHz to 40 MHz			9 mA Max.	3.3 V±0.3 V	30 pF	OE/ ST	
SG-636PDE		5 mA Max.		2.5 V±0.25 V	15 pF	OE		
SG-636PTW/STW	32.001 MHz to 135 MHz	±50 × 10 ⁻⁶ ±100 × 10 ⁻⁶	-20 °C to +70 °C	45 mA Max.	5.0 V±0.5 V	5 TTL	OE/ ST	
SG-636PHW/SHW				15 pF				
SG-636PCW/SCW				28 mA Max.	3.3 V±0.3 V	15 pF		
SG-636PTG/PHG	2.21675 MHz to 33 MHz			25 mA Max.	4.5 V to 5.5 V	25 pF	OE	
SG-636PCG/SCG			12 mA Max.	2.7 V to 3.6 V	ST			
SG-51/531/615P	1.025 MHz to 26 MHz	±50 × 10 ⁻⁶ ±100 × 10 ⁻⁶	-20 °C to +70 °C	23 mA Max.	5.0 V±0.5 V	10TTL, 50 pF	OE	
SG-51/531/615PTJ	26.001 MHz to 66.667 MHz			35 mA Max.		5 TTL		
SG-51/531/615PH						50 pF		
SG-531/615PTW/STW	55.001 MHz to 135 MHz	±50, ±100 × 10 ⁻⁶ (-20 °C to +70 °C) ±100 × 10 ⁻⁶	-20 °C to +70 °C (-40 °C to +85 °C) *1	45 mA Max.	3.3 V±0.3 V	5 TTL	OE/ ST	
SG-531/615PHW/SHW				15 pF				
SG-531/615PCW/SCW				26.001 MHz to 135 MHz		28 mA Max.		15 pF
SG-531/615PCG/SCG	1.5 MHz to 26 MHz			12 mA Max.	2.7 V to 3.6 V	25 pF		
SG-615PCN	26.001 MHz to 66.667 MHz			20 mA Max.	3.0 V to 3.6 V	15 pF	OE	

*1 Except : PTW, STW, PHW, SHW

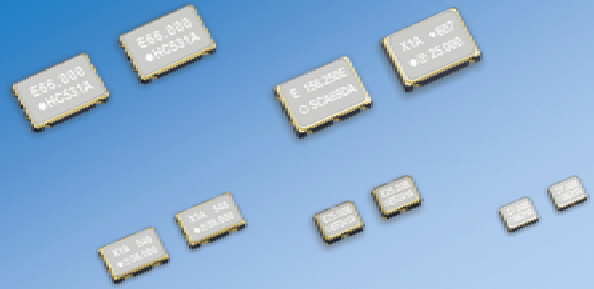


CRYSTAL OSCILLATOR









SPXO (Ceramic package type)

Features

- High-density mounting-type SMD.
- Low current consumption by output enable function (OE) or standby function ($\overline{\text{ST}}$).



■SPXO Ceramic package type

Model	Actual size (mm) Typ.	Frequency					
		1 Hz	1 MHz	50 MHz	100 MHz	500 MHz	800 MHz
SG-211 series	 2.5×2.0×0.7 t	2.375 MHz		60 MHz			
SG-210 series	 2.5×2.0×0.8 t	2 MHz		48 MHz			
SG-310 series	 3.2×2.5×1.05 t	2 MHz		80 MHz			
TCO-710x series	 5.0×3.2×1.0 t	1.5 MHz		75 MHz			
SG-710 series	 7.3×4.8×1.3 t	1.8 MHz		125 MHz			
SG-770 series	 7.0×5.0×1.6 t		50 MHz	230 MHz			
SG-771 PCD	 7.0×5.0×1.6 t		80 MHz	175 MHz			
TCO-708x series	 7.0×5.0×1.6 t	1.5 MHz		160 MHz			

► Specifications

Model	Item	Output frequency range	Frequency tolerance (Temperature range)	Operating temperature	Current consumption	Supply voltage	Output load condition	Output control
SG-211SEE	2.375 MHz to 60 MHz		$\pm 15 \times 10^{-6}$ $\pm 20 \times 10^{-6}$	-40 °C to +85 °C -20 °C to +70 °C	4.5 mA Max.	1.6 V to 2.2 V	15 pF	$\overline{\text{ST}}$
SG-211SDE					5 mA Max.	2.2 V to 2.7 V		
SG-211SCE					6 mA Max.	2.7 V to 3.6 V		
SG-210SGB	2 MHz to 32 MHz		$\pm 50 \times 10^{-6}$	-40 °C to +85 °C	1.0 mA Max.	1.3 V to 1.7 V	15 pF	$\overline{\text{ST}}$
SG-210SEB	2 MHz to 48 MHz		$\pm 50, \pm 100 \times 10^{-6}$ $\pm 100, \pm 150 \times 10^{-6}$ $\pm 50, \pm 100 \times 10^{-6}$ $\pm 100, \pm 150 \times 10^{-6}$ $\pm 50, \pm 100 \times 10^{-6}$ $\pm 100, \pm 150 \times 10^{-6}$	-40 °C to +85 °C	1.6 mA Max.	1.6 V to 2.2 V		
				-40 °C to +125 °C	2.0 mA Max.			
SG-210SDB				-40 °C to +85 °C	2.4 mA Max.	2.2 V to 3.0 V		
				-40 °C to +125 °C	3.0 mA Max.			
SG-210SCB				-40 °C to +85 °C	3.0 mA Max.	2.7 V to 3.6 V		
				-40 °C to +125 °C	4.0 mA Max.			
SG-310SEF	2 MHz to 48 MHz		$\pm 50, \pm 100 \times 10^{-6}$ (-20 °C to +70 °C) $\pm 100 \times 10^{-6}$ (-40 °C to +85 °C)	-20 °C to +70 °C (-40 °C to +85 °C)	3.0 mA Max.	1.6 V to 2.2 V	15 pF	$\overline{\text{ST}}$
SG-310SDF					3.5 mA Max.	2.2 V to 3.0 V		
SG-310SCF					4.5 mA Max.	2.7 V to 3.6 V		
SG-310SDN	3 MHz to 80 MHz		$\pm 20, \pm 25, \pm 50, \pm 100 \times 10^{-6}$ $\pm 20, \pm 25 \times 10^{-6}$ $\pm 20, \pm 25, \pm 100 \times 10^{-6}$ $\pm 20, \pm 25, \pm 50, \pm 100 \times 10^{-6}$ $\pm 20, \pm 25 \times 10^{-6}$ $\pm 20, \pm 25, \pm 100 \times 10^{-6}$	-20 °C to +70 °C	6.0 mA Max.	2.2 V to 2.7 V	15 pF	$\overline{\text{ST}}$
				-30 °C to +85 °C				
-40 °C to +85 °C								
SG-310SCN				-20 °C to +70 °C	7.0 mA Max.	2.7 V to 3.6 V		
				-30 °C to +85 °C				
				-40 °C to +85 °C				
TCO-7106X1A	1.5 MHz to 75 MHz		$\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$ $\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$ $\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$ $\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$	0 °C to +70 °C	20 mA Max.	3.3 V±0.33 V	15 pF	$\overline{\text{ST}}$
TCO-7107X1A				-10 °C to +70 °C				
TCO-7106X1A1								
TCO-7107X1A1								
TCO-7106X1A2				-20 °C to +70 °C				
TCO-7107X1A2				-40 °C to +85 °C				
TCO-7106X1A4								
TCO-7107X1A4								
SG-710PTK	1.8 MHz to 50 MHz	$\pm 25, \pm 50, \pm 100 \times 10^{-6}$ (-10 °C to +70 °C)	-10 °C to +70 °C (-40 °C to +85 °C)	24 mA Max.	5.0 V±0.5 V	10 TTL	OE	
SG-710PHK	40 mA Max.			50 pF				
SG-710ECK	1.8 MHz to 125 MHz	$\pm 50, \pm 100 \times 10^{-6}$ (-40 °C to +85 °C)		30 mA Max.	3.3 V±0.3 V	15 pF	$\overline{\text{ST}}$	
SG-770SDD	50 MHz to 230 MHz	$\pm 50 \times 10^{-6}$	0 °C to +70 °C	90 mA Max.	2.5 V±0.125 V	LV-PECL	$\overline{\text{ST}}$	
SG-770SCD					3.3 V±0.165 V			
SG-771 PCD	80 MHz to 175 MHz	$\pm 20 \times 10^{-6}$	-10 °C to +70 °C	70 mA Max.	3.3 V±0.165 V	LV-PECL	OE	
TCO-7085X1A*	1.5 MHz to 160 MHz	$\pm 25 \times 10^{-6}$ $\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$	0 °C to +70 °C	20 mA Max.	3.3 V±0.165 V	15 pF	$\overline{\text{ST}}$	
TCO-7086X1A*			-10 °C to +70 °C	(1.5 to 75 MHz) 50 mA Max.	3.3 V±0.33 V			
TCO-7087X1A*			-20 °C to +70 °C -40 °C to +85 °C	(75 to 160 MHz)	3.3 V±0.33 V			
TCO-7085D1A*	1.5 MHz to 75 MHz	$\pm 25 \times 10^{-6}$ $\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$	0 °C to +70 °C	20 mA Max.	5.0 V±0.25 V	15 pF	$\overline{\text{ST}}$	
TCO-7086D1A*			-10 °C to +70 °C	(1.5 to 30 MHz) 40 mA Max.	5.0 V±0.5 V			
TCO-7087D1A*			-20 °C to +70 °C -40 °C to +85 °C	(30 to 75 MHz)	5.0 V±0.5 V			

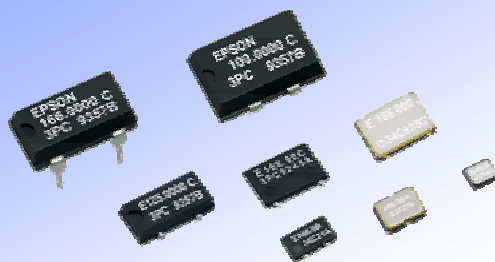


CRYSTAL OSCILLATOR

















Programmable type
SG-8003 series

●Features

- ▶Wide frequency output by PLL technology.
Short mass production lead time and sample lead time.
- ▶SG-Writer available purchase.



■Programmable type

Model	Actual size (mm)		Supply voltage	Frequency tolerance Operating temperature	Frequency			
					1 Hz	1 MHz	50 MHz	100 MHz
	 2.1×1.7×0.75 t (Typ.)	SE/PE	1.6 V to 2.2 V	B,C,M,L	1.0 MHz			166 MHz
		SD/PD	2.2 V to 2.7 V					
		SC/PC	2.7 V to 3.6 V					
	 3.2×2.5×1.05 t (Typ.)	SE/PE	1.6 V to 2.2 V	B,C,M,L	1.0 MHz			166 MHz
		SD/PD	2.2 V to 2.7 V					
		SC/PC	2.7 V to 3.6 V					
	 5.0×3.2×1.2 t (Max.)	SE/PE	1.6 V to 2.2 V	B,C,M,L	1.0 MHz			166 MHz
		SD/PD	2.2 V to 2.7 V					
		SC/PC	2.7 V to 3.6 V					
	 7.1×5.1×1.5 t (Max.)	SE/PE	1.6 V to 2.2 V	B,C,M,L	1.0 MHz			166 MHz
		SD/PD	2.2 V to 2.7 V					
		SC/PC	2.7 V to 3.6 V					
	 7.0×5.0×1.4 t (Typ.)	SE/PE	1.6 V to 2.2 V	B,C,M,L	1.0 MHz			166 MHz
		SD/PD	2.2 V to 2.7 V					
		SC/PC	2.7 V to 3.6 V					
	 10.5×5.8×2.7 t (Max.)	SE/PE	1.6 V to 2.2 V	B,C,M,L	1.0 MHz			166 MHz
		SD/PD	2.2 V to 2.7 V					
		SC/PC	2.7 V to 3.6 V					
	 14.0×9.8×4.7 t (Max.)	SE/PE	1.6 V to 2.2 V	B,C,M,L	1.0 MHz			166 MHz
		SD/PD	2.2 V to 2.7 V					
		SC/PC	2.7 V to 3.6 V					
	 DIP half size	SE/PE	1.6 V to 2.2 V	B,C,M,L	1.0 MHz			166 MHz
		SD/PD	2.2 V to 2.7 V					
		SC/PC	2.7 V to 3.6 V					

Frequency tolerance : B:±50×10⁻⁶ (-20 °C to +70 °C), C:±100×10⁻⁶ (-20 °C to +70 °C), M:±100×10⁻⁶ (-40 °C to +85 °C), L:±50×10⁻⁶ (-40 °C to +85 °C)

► Specifications

Model	Item	Output frequency range	Frequency tolerance (Temperature range)	Operating temperature	Current consumption	Supply voltage	Output load condition	Output Control *1
SG-8003 series	PE/SE	1 MHz to 166 MHz	±50, ±100 × 10 ⁻⁶ (-20 °C to +70 °C) ±50, ±100 × 10 ⁻⁶ (-40 °C to +85 °C)	-20 °C to +70 °C (-40 °C to +85 °C)	10 mA Max.	1.6 V to 2.2 V	15 pF	OE/ $\overline{\text{ST}}$
	PD/SD				15 mA Max.	2.2 V to 2.7 V		
	PC/SC					2.7 V to 3.6 V		

*1 OE function : PE,PD,PC $\overline{\text{ST}}$ function : SE,SD,SC

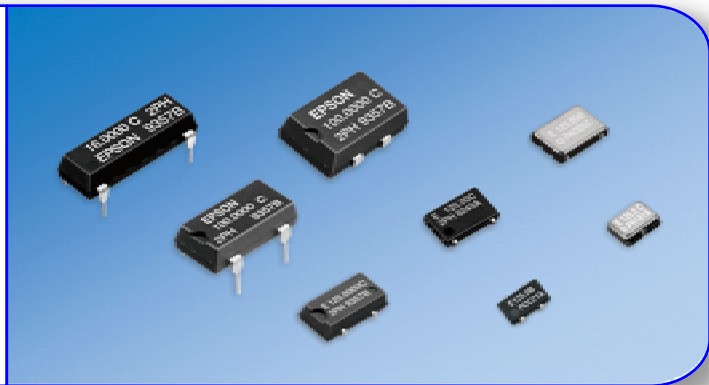


CRYSTAL OSCILLATOR

Programmable type
SG-8002 series

●Features

- ▶ Wide frequency output by PLL technology.
Short mass production lead time and sample lead time.
- ▶ SG-Writer available purchase.



■Programmable type

Model		Actual size (mm)		Supply voltage	Frequency tolerance Operating temperature	Frequency			
						1 Hz	1 MHz	50 MHz	100 MHz
	SG-8002CE	 3.2×2.5×1.05 t (Typ.)	PT/ST PH/SH	4.5 V to 5.5 V	B,C	1.0 MHz	1.0 MHz	27 MHz	125 MHz
			PC SC	3.0 V to 3.6 V (2.7V to 3.6 V)	M	1.0 MHz	1.0 MHz	27 MHz	125 MHz
	SG-8002LB	 5.0×3.2×1.2 t (Max.)	PH/SH	5.0 V ±0.5 V	B,C	1.0 MHz	1.0 MHz	80 MHz	125 MHz
			PC/SC	3.3 V ±0.3 V	M,L	1.0 MHz	1.0 MHz	27 MHz	125 MHz
	SG-8002JF	 7.1×5.1×1.5 t (Max.)	PT/ST PH/SH	4.5 V to 5.5 V	B,C	1.0 MHz	1.0 MHz	40 MHz	125 MHz
			PC SC	3.0 V to 3.6 V (2.7V to 3.6 V)	M	1.0 MHz	1.0 MHz	40 MHz	125 MHz
	SG-8002CA	 7.0×5.0×1.4 t (Typ.)	PT/ST PH/SH	4.5 V to 5.5 V	B,C	1.0 MHz	1.0 MHz	55 MHz	125 MHz
			PC SC	3.0 V to 3.6 V (2.7V to 3.6 V)	M	1.0 MHz	1.0 MHz	55 MHz	125 MHz
	SG-8002JC	 10.5×5.8×2.7 t (Max.)	PT/ST PH/SH	4.5 V to 5.5 V	B,C	1.0 MHz	1.0 MHz	125 MHz	125 MHz
			PC SC	3.0 V to 3.6 V (2.7V to 3.6 V)	M	1.0 MHz	1.0 MHz	125 MHz	125 MHz
	SG-8002JA	 14.0×9.8×4.7 t (Max.)	PT/ST PH/SH	4.5 V to 5.5 V	B,C	1.0 MHz	1.0 MHz	55 MHz	125 MHz
			PC SC	3.0 V to 3.6 V (2.7V to 3.6 V)	M	1.0 MHz	1.0 MHz	55 MHz	125 MHz
	SG-8002DC	 DIP half size	PT/ST PH/SH	4.5 V to 5.5 V	B,C	1.0 MHz	1.0 MHz	55 MHz	125 MHz
			PC SC	3.0 V to 3.6 V (2.7V to 3.6 V)	M	1.0 MHz	1.0 MHz	55 MHz	125 MHz
	SG-8002DB	 DIP full size	PT/ST PH/SH	4.5 V to 5.5 V	B,C	1.0 MHz	1.0 MHz	55 MHz	125 MHz
			PC SC	3.0 V to 3.6 V (2.7V to 3.6 V)	M	1.0 MHz	1.0 MHz	55 MHz	125 MHz

Frequency tolerance : B:±50×10⁻⁶ (-20 °C to +70 °C), C:±100×10⁻⁶ (-20 °C to +70 °C), M:±100×10⁻⁶ (-40 °C to +85 °C), L:±50×10⁻⁶ (-40 °C to +85 °C)

►Specifications

Model	Item	Output frequency range	Frequency tolerance (Temperature range)	Operating temperature	Current consumption	Supply voltage	Output load condition	Output Control *2
SG-8002CE	PT/ST	1 MHz to 125 MHz	±50, ±100 × 10 ⁻⁶ (-20 °C to +70 °C) ±100 × 10 ⁻⁶ (-40 °C to +85 °C)	-20 °C to +70 °C (-40 °C to +85 °C)	40 mA Max.	4.5 V to 5.5 V	5TTL	OE/ $\overline{\text{ST}}$
	PH/SH				28 mA Max.	2.7 V to 3.6 V	15 pF	
	PC/SC				28 mA Max.	2.7 V to 3.6 V	15 pF	
SG-8002LB	PH/SH	1 MHz to 80 MHz	±50, ±100 × 10 ⁻⁶ (-20 °C to +70 °C) ±50, ±100 × 10 ⁻⁶ (-40 °C to +85 °C)	-20 °C to +70 °C (-40 °C to +85 °C)	30 mA Max.	4.5 V to 5.5 V	15 pF	OE/ $\overline{\text{ST}}$
	PC/SC	1 MHz to 125 MHz			28 mA Max.	2.7 V to 3.6 V	15 pF	
SG-8002CA/JF/JA/JC/DB/DC	PT/ST	1 MHz to 125 MHz	±50, ±100 × 10 ⁻⁶ (-20 °C to +70 °C) ±100 × 10 ⁻⁶ *1 (-40 °C to +85 °C)	-20 °C to +70 °C (-40 °C to +85 °C)	45 mA Max.	4.5 V to 5.5 V	5 TTL	OE/ $\overline{\text{ST}}$
	PH/SH				28 mA Max.	2.7 V to 3.6 V	15 pF	
	PC/SC				28 mA Max.	2.7 V to 3.6 V	15 pF	

*1 Except : JC

*2 OE function : PE,PD,PC,PT,PH $\overline{\text{ST}}$ function : SE,SD,SC,ST,SH

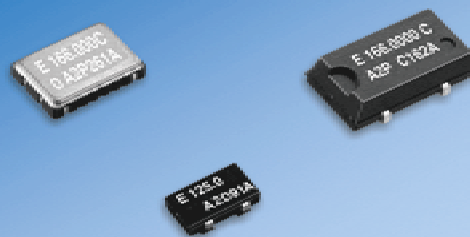


CRYSTAL OSCILLATOR

Spread Spectrum

Features

- Support the EMI measure with the SS (Spread spectrum) function.



Spread Spectrum

Model	Actual size (mm)	Frequency					
		1 Hz	1 MHz	50 MHz	100 MHz	500 MHz	800 MHz
SG-9001 LB	5.0×3.2×1.2 t (Max.)	10 MHz			135 MHz		
SG-9001 CA	7.0×5.0×1.4 t (Typ.)	10 MHz			166 MHz		
SG-9001 JC	10.5×5.8×2.7 t (Max.)	10 MHz			166 MHz		

Spread Spectrum

Model	Item	Output frequency range	Frequency tolerance	Operating temperature	Current consumption	Supply voltage	Output load condition	Output control
SG-9001LB		10 MHz to 135 MHz	—	-20 °C to +70 °C	30 mA Max.	3.3 V±0.3 V	15 pF	OE
SG-9001CA/JC		10 MHz to 166 MHz						

*1 SG-9001CA: The "SS ON/OFF" function is attached.

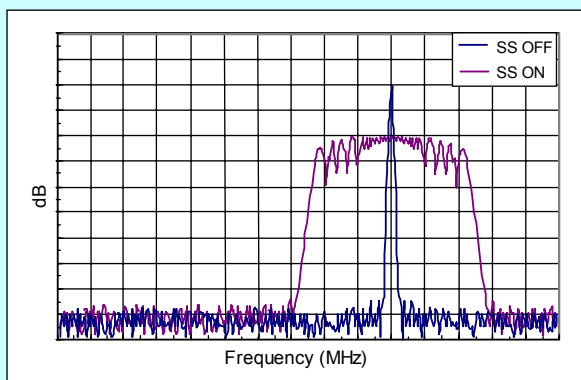
Bits of knowledge

Reducing the EMI level with spectrum spreading against the nominal and higher harmonics frequencies by applying the frequency modulation among the indicated frequency domain on the output frequency.

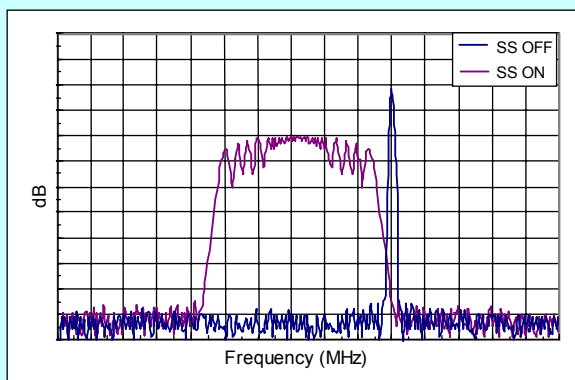
Two type of spread spectrum, "Center Spread" and "Down Spread" are available.

The example of both spread spectrum type is shown below.

Center



Down



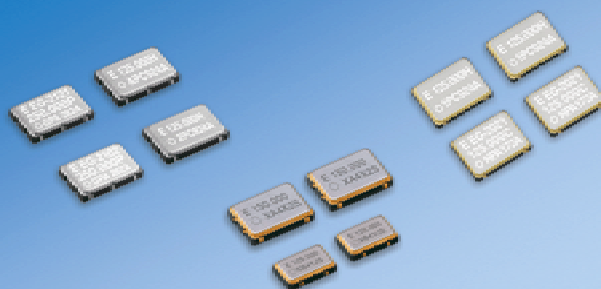


CRYSTAL OSCILLATOR

Low-jitter SAW Oscillator

•Features

- Low-jitter SAW oscillator with SAW.



■Low jitter SAW

	Model	Actual size (mm) Typ.	Frequency					
			1 Hz	1 MHz	50 MHz	100 MHz	500 MHz	800 MHz
	XG-1000CA				50 MHz	170 MHz		
	XG-1000CB				50 MHz	170 MHz		
	EG-2021CA (2.5 V CMOS)				62.5 MHz	250 MHz		
	EG-2001CA (3.3 V CMOS)				106.25 MHz	170 MHz		
	EG-2002CA (3.3 V LV-TTL)				62.5 MHz	170 MHz		
	EG-2121CA Differential LV-PECL			53.125 MHz			500 MHz	
				53.125 MHz			700 MHz	
	EG-2102CA Differential LV-PECL				100 MHz		700 MHz	
				53.125 MHz			700 MHz	
	EG-2101CA (3.3 V Differential LV-PECL)				62.5 MHz	99.999 MHz		

► Specifications

Item		Output frequency range	Frequency tolerance	Operating temperature	Current consumption	Supply voltage	Output load condition	Output control
Model								
XG-1000CA XG-1000CB	CMOS	50 MHz to 170 MHz	$\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$	-10 °C to +70 °C	20 mAMax.	1.8 V \pm 0.1 V	15 pF	OE
					25 mAMax.	2.5 V \pm 0.125 V		
					35 mAMax.	3.3 V \pm 0.3 V		
EG-2021CA	CMOS	62.5 MHz to 250 MHz	$\pm 50 \times 10^{-6}$ $\pm 100 \times 10^{-6}$	0 °C to +70 °C -5 °C to +85 °C	30 mAMax.	2.5 V \pm 0.125 V	15 pF	OE
EG-2001CA	CMOS	106.25 MHz to 170 MHz		0 °C to +70 °C	50 mAMax.	3.3 V \pm 0.3 V	15 pF	
EG-2002CA	LV-TTL	62.5 MHz to 170 MHz		0 °C to +70 °C	60 mAMax.	3.3 V \pm 0.3 V	15 pF	
EG-2121CA	Differential LV-PECL	53.125 MHz to 500 MHz		0 °C to +70 °C	80 mAMax.	2.5 V \pm 0.125 V	50 Ω	
	LVDS	53.125 MHz to 700 MHz		0 °C to +70 °C	30 mAMax.		100 Ω	
EG-2102CA	Differential LV-PECL	100 MHz to 700 MHz		-5 °C to +85 °C	100 mAMax.	3.3 V \pm 0.3 V	50 Ω	
	LVDS	53.125 MHz to 700 MHz		-20 °C to +70 °C *1	45 mAMax.		100 Ω	
EG-2101CA	Differential LV-PECL	62.5 MHz to 99.999 MHz		0 °C to +70 °C	60 mAMax.	3.3 V \pm 0.15 V	50 Ω	

*1 Please contact us for inquiries about -20 °C to +70 °C

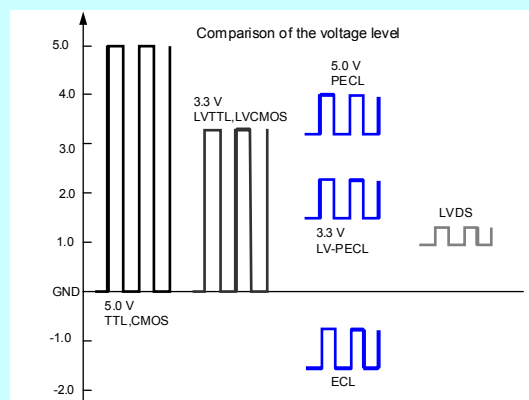
Bits of knowledge

Kind of interface

For long, the power supply voltage of the logic circuit has been unified to 5.0V. However, the power supply voltage logic circuit of 3.3V has come to be commercialized, because it solves the problem of generation with large-scale accumulation and highspeed.

LVCMOS, LVTTL, LVECL (LVPECL), LVDS etc.

that the interface specification prefixed LV of Low Voltage are used.



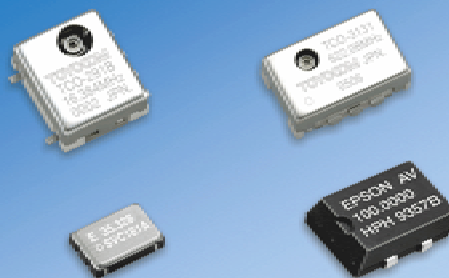


CRYSTAL OSCILLATOR

High-Stability type Multi-Output type

Features

- High stability of frequency in the range of wide temperature.



High-stability

Model	Actual size (mm) Max.	Frequency					
		1 Hz	1 MHz	50 MHz	100 MHz	500 MHz	800 MHz
HG-2150CA	7.0×5.0×1.5 t	1 MHz		60 MHz			
HG-8002JA	EPSON AV 100.0000 HPH 9357B 14.0×9.8×4.7 t	1 MHz			125 MHz		
TCO-391J	11.4×9.6×5.0 t		60 MHz		230 MHz		
TCO-3100 series	13.9×9.8×4.7 t		60 MHz				800 MHz

Specifications

Model	Item	Output frequency range	Frequency tolerance (Temperature range)	Operating temperature	Current consumption	Supply voltage	Output load condition	Aging (year Max.)	Output control
HG-2150CA SVC/BXC	1 MHz to 60 MHz		S: $\pm 15 \times 10^{-6}$ (-20 °C to +70 °C) B: $\pm 25 \times 10^{-6}$ (-40 °C to +85 °C)	-20 °C to +70 °C -40 °C to +85 °C	25 mA Max.	3.3 V ± 0.3 V	15 pF	$\pm 10 \times 10^{-6}$ (10 years)	OE
HG-2150CA SVH/BXH					30 mA Max.	5.0 V ± 0.5 V			
HG-8002JA PT/ST	1 MHz to 125 MHz		$\pm 20, \pm 25 \times 10^{-6}$ (-20 °C to +70 °C) $\pm 30 \times 10^{-6}$ (-40 °C to +85 °C)	-20 °C to +70 °C -40 °C to +85 °C	45 mA Max.	5.0 V ± 0.25 V	2 TTL	$\pm 2 \times 10^{-6}$ (First year)	OE/ST
HG-8002JA PH/SH							15 pF		
HG-8002JA PC/SC					28 mA Max.	3.3 V ± 0.165 V	15 pF		
TCO-391J	60 MHz to 230 MHz		$\pm 35 \times 10^{-6}$	-40 °C to +85 °C	20 mA Max.	3.3 V ± 0.165 V	50 Ω	$\pm 5 \times 10^{-6}$ (First year)	—
TCO-3111	60 MHz to 800 MHz		$\pm 50 \times 10^{-6}$ (Inclusive 1 year aging)	-40 °C to +85 °C	65 mA Max.	3.3 V ± 0.165 V	LVPECL	—	—
TCO-3112						5.0 V ± 0.25 V	PECL	—	
TCO-3114	60 MHz to 230 MHz		$\pm 60 \times 10^{-6}$ (Inclusive 20 years aging)	-40 °C to +85 °C	40 mA Max.	3.3 V ± 0.165 V	LVDS	—	—
TCO-3131	60 MHz to 700 MHz				75 mA Max.	3.3 V ± 0.165 V	LVPECL	—	

Multi-output

Model	Actual size (mm)	Frequency					
		1 Hz	1 MHz	50 MHz	100 MHz	500 MHz	800 MHz
MG-5020JE	M5020 E 1234A 7.0×6.0×1.5 t (Max.)	32.768 kHz		48.00512 MHz			

Specifications

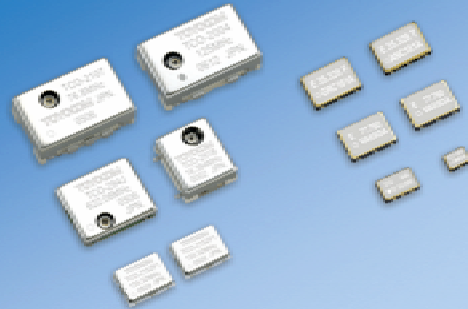
Model	Item	Output frequency range	Frequency tolerance	Operating temperature	Current consumption	Supply voltage	Output load condition	Output control
MG-5020JE		32.768 kHz	$5 \pm 23 \times 10^{-6}$	-40 °C to +85 °C	3 μ A Max.	1.8 V to 3.6 V	15 pF	PWD
		48.00512 MHz	$\pm 100 \times 10^{-6}$		15 mA Max.	2.7 V to 3.6 V		



VOLTAGE CONTROLLED CRYSTAL OSCILLATOR VCXO

●Features

- ▶ Small packaging SMD type due to trimmer less design.
- ▶ With HFF-XTAL technology.
Fundamental oscillation (60 MHz to 230 MHz)
Multiplier oscillation (fo≥230 MHz)



■VCXO

Model		Actual size (mm)		Frequency					
				1 Hz	1 MHz	50 MHz	100 MHz	500 MHz	800 MHz
	VG-4231CE		3.2×2.5×1.05 t (Typ.)	3 MHz		60 MHz			
	VG-4231CB		5.0×3.2×1.2 t (Typ.)	1 MHz		60 MHz			
	VG-4531CB		5.0×3.2×1.2 t (Typ.)		60 MHz		80 MHz		
	VG-4231CA		7.0×5.0×1.4 t (Typ.)	1 MHz		60 MHz			
	VG-4501/4502CA		7.0×5.0×1.6 t (Typ.)		60 MHz		80 MHz		
	VG-4511CA		7.0×5.0×1.6 t (Typ.)			80 MHz	170 MHz		
	VG-1201CA		7.0×5.0×1.4 t (Typ.)	1 MHz		60 MHz			
	TCO-291J		11.4×9.6×5.0 t (Max.)		60 MHz		230 MHz		
	TCO-294J		11.4×9.6×2.0 t (Max.)		60 MHz		690 MHz		
	TCO-2152		7.0×5.2×2.0 t (Max.)			77 MHz	230 MHz		
	TCO-2000 series		13.9×9.8×4.7 t (Max.)	8 MHz		125 MHz			
	TCO-2100 series		13.9×9.8×4.7 t (Max.)	1 MHz		800 MHz			

▶ Specifications

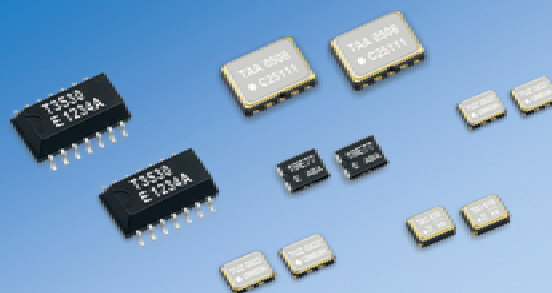
Item	Output frequency range	Frequency tolerance	Frequency control range	Current consumption	Operating temperature	Supply voltage	Output load condition	Aging (/ year Max.)	Output control
Model									
VG-4231CE **CM	3 MHz to 60 MHz	±30 × 10 ⁻⁶	±140 × 10 ⁻⁶	7 mA Max.	-20 °C to +70 °C	3.3 V±0.3 V	15 pF	±5 × 10 ⁻⁶ (5 years)	—
VG-4231CE **BM		±37 × 10 ⁻⁶			-40 °C to +85 °C	2.8 V±0.2 V			
VG-4231CE **EM	24 MHz to 30 MHz		±120 × 10 ⁻⁶	1.2 mA Max.		1.8 V±0.2 V			
VG-4231CB	1 MHz to 60 MHz			10 mA Max.	0 °C to +70 °C			Includ Frequency tolerance (20 years)	OE
VG-4531CB	60 MHz to 80 MHz	±50 × 10 ⁻⁶	±50 × 10 ⁻⁶	15 mA Max.	-20 °C to +70 °C	3.3 V±0.165 V	15 pF		
					-40 °C to +85 °C				
VG-4231CA*RC	1 MHz to 60 MHz	±35 × 10 ⁻⁶	±120 × 10 ⁻⁶	10 mA Max.	-20 °C to +70 °C	3.3 V±0.3 V	15 pF	±10 × 10 ⁻⁶ (10 years)	OE
VG-4231CA*RH		±50 × 10 ⁻⁶	±130 × 10 ⁻⁶	20 mA Max.	-40 °C to +85 °C	5.0 V±0.5 V			
VG-4501CA	60 MHz to 80 MHz	±50 × 10 ⁻⁶	±100 × 10 ⁻⁶	35 mA Max.	0 °C to +70 °C	3.3 V±0.165 V	15 pF	Includ Frequency tolerance (20 years)	OE
VG-4502CA	60 MHz to 80 MHz	±50 × 10 ⁻⁶	±150 × 10 ⁻⁶	35 mA Max.	-20 °C to +70 °C	3.3 V±0.165 V	15 pF		OE
VG-4511CA	80 MHz to 170 MHz	±50 × 10 ⁻⁶	±50 × 10 ⁻⁶	70 mA Max.	-40 °C to +85 °C	3.3 V±0.165 V	LV-PECL		OE
VG-1201CA**C				25 mA Max.	-20 °C to +70 °C	3.3 V±0.3 V			
VG-1201CA**H	1 MHz to 60 MHz	±20 × 10 ⁻⁶	±50 × 10 ⁻⁶	30 mA Max.	-40 °C to +85 °C	5.0 V±0.5 V	15 pF	±10 × 10 ⁻⁶ (10 years)	OE
		±25 × 10 ⁻⁶	±100 × 10 ⁻⁶						
TCO-291J	60 MHz to 230 MHz	±35 × 10 ⁻⁶	±100 × 10 ⁻⁶	20 mA Max.	-40 °C to +85 °C	3.3 V±0.165 V	50 Ω	±5 × 10 ⁻⁶ (First years)	—
TCO-294J	60 MHz to 690 MHz	±35 × 10 ⁻⁶	±100 × 10 ⁻⁶	40 mA Max.	-40 °C to +85 °C	3.3 V±0.165 V	50 Ω		—
TCO-2152	77 MHz to 230 MHz	±35 × 10 ⁻⁶	±100 × 10 ⁻⁶	70 mA Max.	-40 °C to +85 °C	3.3 V±0.165 V	LV-PECL		OE
TCO-2001 / 2101	8 MHz to 78 MHz			50 mA Max.		5.0 V±0.25 V	2 TTL		—
TCO-2003 / 2103							15 pF		
TCO-2002 / 2102	8 MHz to 125 MHz					3.3 V±0.165 V	2 TTL	Includ Frequency tolerance (First year or 20 years)	—
TCO-2004 / 2104							15 pF		
TCO-2106	1 MHz to 80 MHz	±50 × 10 ⁻⁶	±100 × 10 ⁻⁶	30 mA Max.	-40 °C to +85 °C	3.3 V±0.165 V	2 TTL		OE
TCO-2107		±60 × 10 ⁻⁶	±110 × 10 ⁻⁶				15 pF		
TCO-2111			±150 × 10 ⁻⁶	65 mA Max.		3.3 V±0.165 V	LV-PECL		—
TCO-2112	60 MHz to 800 MHz		±160 × 10 ⁻⁶			5.0 V±0.25 V	PECL		
TCO-2114				40 mA Max.		3.3 V±0.165 V	LVDS		
TCO-2131	60 MHz to 700 MHz			75 mA Max.		3.3 V±0.165 V	LV-PECL		OE













TEMPERATURE COMPENSATED CRYSTAL OSCILLATOR TCXO / VC-TCXO

Features

- ▶ Many lineups for wide application of a cellular phone, base station, etc.



TCXO / VC-TCXO

Model		Actual size (mm)		Frequency			
				1 Hz	1 MHz	50 MHz	100 MHz
	TG-3530SA		10.1×7.4×3.2t (Typ.)	●32.768 kHz			
	TG-5021BA		2.1×1.7×0.75t (Typ.)		13 MHz	52 MHz	
	TG-5005CG		2.5×2.0×0.9 t (Typ.)		13 MHz	40 MHz	
	TG-5010CG		2.5×2.0×0.9 t (Typ.)		13 MHz	40 MHz	
	TG-5005CE		3.2×2.5×0.9t (Typ.)		10 MHz	40 MHz	
	TG-5010LH		3.3×2.5×0.96t (Typ.)		10 MHz	40 MHz	
	TCO-5860 series		3.2×2.5×0.9t (Typ.)		10 MHz	40 MHz	
	TCO-5060/5160 series		7.0×5.0×1.9t (Typ.)		10 MHz	51.84 MHz	

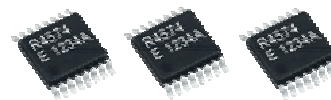
Specifications

Model \ Item	Output frequency range	Frequency tolerance	Frequency / temperature characteristics	Current consumption	Operating temperature	Supply voltage	Output load condition	Output control
TG-3530SA	32.768 kHz	$\pm 5.0 \times 10^{-6}$ (-20 °C to +70 °C)		6 μ A Max.	-40 °C to +85 °C	2.2 V to 5.5 V	15 pF	–
TG-5021BA	13 MHz to 52 MHz	$\pm 2.0 \times 10^{-6}$	$\pm 2.0 \times 10^{-6}$	2.0 mA Max.	-30 °C to +85 °C	2.8 V \pm 0.14 V	10 k Ω //10 pF	V _c
TG-5005CG	13 MHz to 40 MHz	$\pm 2.0 \times 10^{-6}$	$\pm 0.5 \times 10^{-6}$	2.0 mA Max.	-30 °C to +85 °C	2.8 V \pm 0.14 V	10 k Ω //10 pF	V _c
TG-5010CG	13 MHz to 40 MHz	$\pm 2.0 \times 10^{-6}$	$\pm 2.0 \times 10^{-6}$	2.0 mA Max.	-30 °C to +85 °C	2.8 V \pm 0.14 V	10 k Ω //10 pF	V _c
TG-5005CE	10 MHz to 40 MHz	$\pm 2.0 \times 10^{-6}$	$\pm 0.5 \times 10^{-6}$	2.0 mA Max.	-30 °C to +85 °C	2.8 V \pm 0.14 V	10 k Ω //10 pF	V _c
TG-5010LH	10 MHz to 40 MHz	$\pm 2.0 \times 10^{-6}$	$\pm 2.0 \times 10^{-6}$	2.0 mA Max.	-30 °C to +85 °C	2.8 V \pm 0.14 V	10 k Ω //10 pF	V _c
TCO-5861	16 MHz to 40 MHz	$\pm 2.0 \times 10^{-6}$	$\pm 2.0 \times 10^{-6}$	2.0 mA Max.	-30 °C to +85 °C	2.8 V \pm 0.14 V	10 k Ω //10 pF	V _c
TCO-5862	10 MHz to 20 MHz							–
TCO-5867								
TCO-5869	16 MHz to 40 MHz							
TCO-5060	10 MHz to 51.84 MHz	$\pm 2.0 \times 10^{-6}$	$\pm 1.0 \times 10^{-6}$	10.0 mA Max.	-40 °C to +85 °C	3.3 V \pm 0.165 V	15 pF	V _c
TCO-5160								–

REAL TIME CLOCK IC. For TG-3530SA

RX-4574 SG

- By combining TG-3530SA with RX-4574SG (real-time clock IC), it is possible to achieve a very high accuracy clock system.
- Functions are compatible with RX-4574 LC and RTC-4574 series (except 32 kHz oscillation function).
- Complies with EU RoHS directive

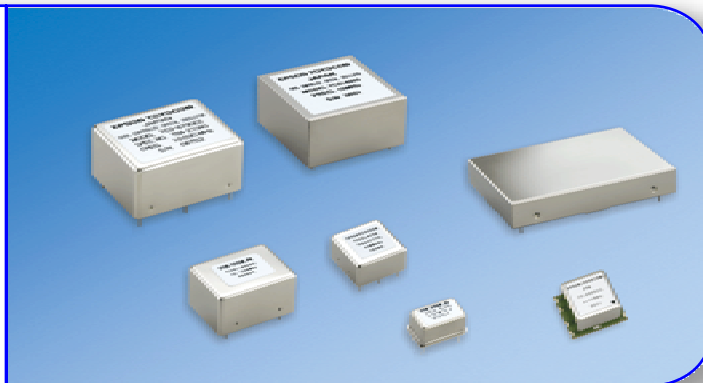




OVEN CONTROLLED CRYSTAL OSCILLATOR OCXO

•Features

- ▶Lineup of the small size, low profile, full SMD package.



■OCXO

Model	Size (mm)	Weight (Max.)	Frequency			
			1 Hz	1 MHz	50 MHz	100 MHz
TCO-6831 series	70×50×12 t (Max.)	100 g		5 MHz ■ 10 MHz		
TCO-676 series	25.4×25.4×12.7 t (Max.)	20 g		10 MHz ■ 20 MHz		
TCO-679 series	20.3×12.7×9.7 t (Typ.)	10 g		10 MHz ■ 20 MHz		
TCO-6920A	50.8×50.8×25.4 t (Max.)	100 g		●10 MHz		
OX-6500GG series	25.4×22×12.1 t (Typ.)	20 g		10 MHz ■ 40 MHz		
OX-6601DL series NEW	36.2×27.2×20.0 t (Max.)	30 g		10 MHz ■ 40 MHz		

▶Specifications

Model	Output frequency range	Frequency / temperature characteristics	Frequency / voltage coefficient	Current consumption (Steady state at +25 °C)	Operating temperature	Supply voltage	Output load condition	Output control
TCO-6831 series	5 MHz to 10 MHz	$\pm 8.0 \times 10^{-9}$	$\pm 2.0 \times 10^{-9}$	850 mA Max.	0 °C to +70 °C	5.0 V \pm 0.25 V	10 k Ω //15 pF	Vc
TCO-676 series	10 MHz to 20 MHz	$\pm 2.0 \times 10^{-8}$	$\pm 5.0 \times 10^{-9}$	650 mA Max.	-10 °C to +70 °C	3.3 V \pm 0.165 V	10 k Ω //10 pF	Vc
				300 mA Max.		5.0 V \pm 0.25 V		
				130 mA Max.		12.0 V \pm 0.6 V		
TCO-679 series	10 MHz to 20 MHz	$\pm 1.0 \times 10^{-7}$	$\pm 1.0 \times 10^{-7}$	160 mA Max.	0 °C to +70 °C	5.0 V \pm 0.25 V	10 k Ω //15 pF	Vc
				70 mA Max.		12.0 V \pm 0.6 V		
TCO-6920A	10 MHz	$\pm 5.0 \times 10^{-10}$	$\pm 2.0 \times 10^{-10}$	300 mA Max.	-30 °C to +70 °C	12.0 V \pm 0.6 V	50 Ω	Vc
OX-6500GG series	10 MHz to 40 MHz	$\pm 2.5 \times 10^{-8}$	$\pm 5.0 \times 10^{-9}$	300 mA Max.	-10 °C to +70 °C	3.3 V \pm 0.165 V	10 k Ω //15 pF	Vc
				200 mA Max.		5.0 V \pm 0.25 V		
OX-6601 DL series	10 MHz to 40 MHz	$\pm 8.0 \times 10^{-9}$	$\pm 2.0 \times 10^{-9}$	300 mA Max.	-10 °C to +70 °C	3.3 V \pm 0.165	10 k Ω //15 pF	Vc
				200 mA Max.		5.0 V \pm 0.25 V		

Bits of knowledge

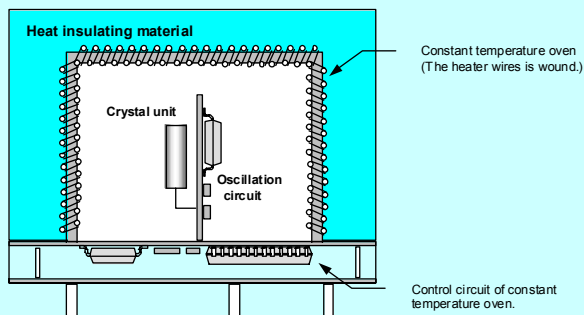
OCXO (Oven Controlled Xtal Oscillator) exhibits an extremely high frequency stability by housing the crystal unit and oscillation circuit department in a constant temperature oven.

As for the crystal unit SC-cut (Stress Compensated-Cut) the crystal unit is used, because the change of the frequency is small to the mechanical stress.

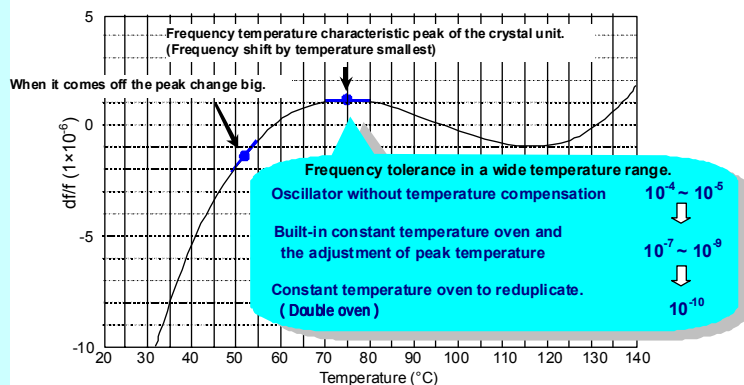
The inside temperature of constant temperature oven is setting up it to the small peak part of the frequency change most to the temperature characteristic of the SC-cut crystal unit.

OCXO of ultra high accuracy is making oven double structure, to make the temperature change of small inside constant temperature oven.

Inside constitution of OCXO



Temperature characteristic of the SC-cut crystal unit and temperature setting of constant temperature oven.



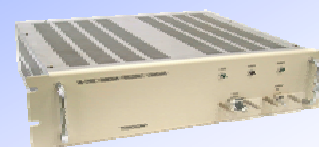
RUBIDIUM ATOMIC OSCILLATOR

●Features

- ▶ Lineup of the small size, portable type, 19 inches rack type.



Rb-3310N



Rb-2110CB

■Rubidium Atomic Oscillator

Model	Size (mm) Typ.	Weight (Typ.)	Frequency	1 Hz	1 MHz	50 MHz	100 MHz
Rb-3310N	89(H)×110(W)×123(D)	2 kg			● 10 MHz		
Rb-2110 CB	99(H)×480(W)×300(D)	12 kg	●	● ● ● 100 kHz, 1 MHz, 3.58 MHz, 10 MHz			

▶ Specifications

Item	Output frequency	Frequency stability (Long term)	Frequency stability (Short term)	Frequency stability (vs Temperature)	Supply voltage
Rb-3310N	10 MHz	$<2.0 \times 10^{-11}/\text{Month}$	$<1.0 \times 10^{-11}/1 \text{ sec}$	$\pm 1.5 \times 10^{-10} / 0^\circ\text{C to } +50^\circ\text{C}$	DC 24 V
Rb-2110CB	10 MHz, 3.58 MHz, 1 MHz, 100 kHz	$<2.0 \times 10^{-11}/\text{Month}$	$<1.0 \times 10^{-11}/1 \text{ sec}$	$\pm 1.5 \times 10^{-10} / 0^\circ\text{C to } +50^\circ\text{C}$	AC 100 V / DC 24 V

Bits of knowledge

The rubidium atom oscillator uses the peculiar spectral line with stable rubidium atom and is the frequency resource of high accuracy. The accuracy raise between 10^{-10} and 10^{-11} .

Inside constitution is composed of a/the rubidium lamp, rubidium gas cells and also crystal oscillator, control circuits, microwave generator etc.

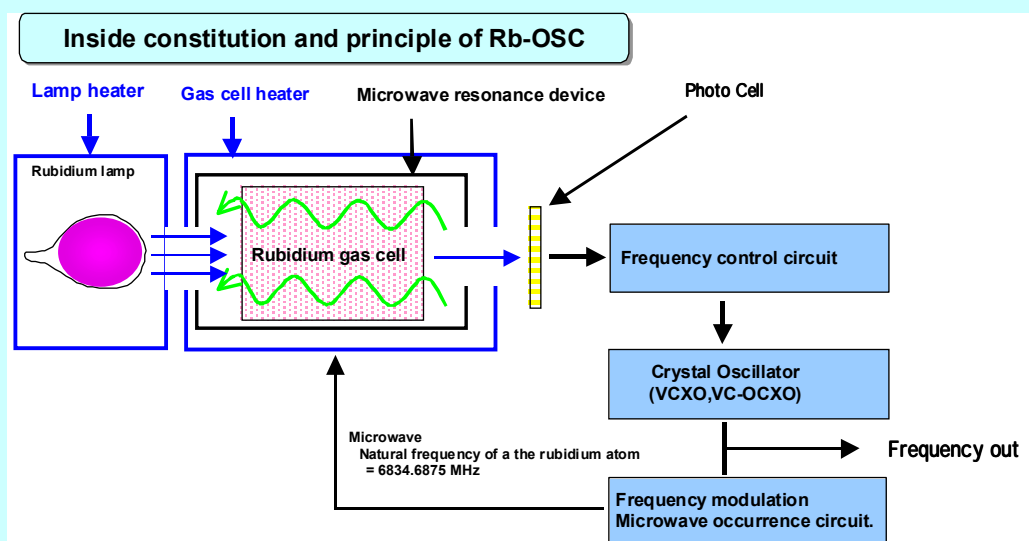
Action principle makes the rubidium gas cell and lamp in the high temperature condition of each 70°C to 110°C and evaporates in a gas state.

When it evaporates, the lamp shines and irradiates the gas cell with this light.

The absorption of the light at this time rises when the microwave supplied from a/the circuit side approach rubidium atom characteristic frequency (6834.6875 MHz)

A/the rubidium atom oscillator increases the absorption of light by making the crystal oscillator that produces microwave higher in accuracy.

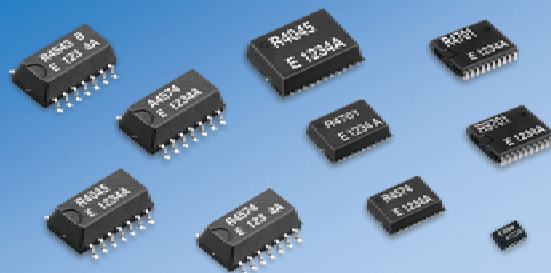
By feed-back and control the change of absorption into the crystal oscillator, it can make 10^{-10} to 10^{-11} of the rubidium atom in accuracy of output frequency.



REAL TIME CLOCK MODULE Serial 4-Wire / Serial 3-Wire

Features

- ▶ Serial interface which can be controlled 4 or 3 signal lines.
- ▶ Built in frequency adjusted 32.768 kHz crystal unit.



Serial 4-Wire / Serial 3-Wire

Category	Model		Actual size (mm)		Features
Serial 4-Wire		RX-4045SA		10.1×7.4×3.2 t (Typ.)	High-Stability
		RX-4045NB		6.3×5.2×1.4 t (Max.)	
		RX-4581NB		6.3×5.2×1.4 t (Max.)	Built-in SRAM
	 	RA-4565SA NEW		10.1×7.4×3.2 t (Typ.)	For Automotive
		RX-4801SA NEW		10.1×7.4×3.2 t (Typ.)	Built-in DTCXO High-Stability
		RTC-9701JE		7.3×6.2×1.5 t (Max.)	Built-in EEPROM
Serial 3-Wire		RTC-4701JE		7.3×6.2×1.5 t (Max.)	Built-in Temperature Sensor
		RTC-4701NB		6.3×5.2×1.4 t (Max.)	
		RTC-4574SA		10.1×7.4×3.2 t (Typ.)	Simple Function
		RTC-4574JE		7.3×6.2×1.5 t (Max.)	
		RTC-4574NB		6.3×5.2×1.4 t (Max.)	
		RX-4574LC		3.6×2.8×1.2 t (Max.)	
	 	RA-4574SA		10.1×7.4×3.2 t (Typ.)	For Automotive
		RTC-4543SA		10.1×7.4×3.2 t (Typ.)	Simple Function
		RTC-4543SB		11.6×8.0×2.0 t (Max.)	
		RX-4575LC		3.6×2.8×1.2 t (Max.)	Built-in external event detection.
		RX-4571LC		3.6×2.8×1.2 t (Max.)	
		RX-4571NB		6.3×5.2×1.4 t (Max.)	Low Backup Voltage
		RX-4571SA		10.1×7.4×3.2 t (Typ.)	

Specifications

Model \ Item	Interface	Frequency tolerance (Standard)	Interface voltage	Clock voltage	Current consumption (Backup)	Memory	Alarm	Time interval of standard pulse	Other features
RX-4045 SA / NB	4-Wire Serial	5±5 × 10 ⁻⁶ 0±5 × 10 ⁻⁶	1.7 V to 5.5 V	1.15 V to 5.5 V	0.48 μA Typ.(3 V)	—	—	32.768 kHz	High-Stability
RX-4581 NB		5±23 × 10 ⁻⁶	1.6 V to 5.5 V	1.6 V to 5.5 V	0.4 μA Typ.(3 V)	128 bit (SRAM)	Minute to Day and day of the week	32.768 kHz to 1/60 Hz	Built-in SRAM
RA-4565SA			1.5 V to 5.5 V	1.5 V to 5.5 V	0.5 μA Typ.(3 V)	—	Minute to Day	32.768 kHz to 1 Hz	For automotive
RX-4801SA		±5 × 10 ⁻⁶	1.8 V to 5.5 V	1.6 V to 5.5 V	0.8 μA Typ.(3 V)	—	Minute to Day	32.768 kHz to 1 Hz	Built-in DTCXO
RTC-9701 JE		5±23 × 10 ⁻⁶	2.7 V to 3.6 V	1.8 V to 5.5 V	0.8 μA Typ.(3 V)	4 k bit (EEPROM)	Minute to Day and day of the week	32.768 kHz	Built-in EEPROM
RTC-4701 JE/NB	3-Wire Serial	5±23 × 10 ⁻⁶	1.6 V to 5.5 V	1.6 V to 5.5 V	0.5 μA Typ.(3 V)	—	Minute to Day and day of the week	32.768 kHz to 1/30 Hz	Built in temperature sensor
RX-4574 LC			1.6 V to 5.5 V	1.3 V to 5.5 V	0.35 μA Typ.(3 V)	—			For automotive
RA-4574 SA			1.6 V to 5.5 V	1.6 V to 5.5 V	0.5 μA Typ.(3 V)	—			
RTC-4574 SA/JE/NB						—			
RTC-4543 SA/SB			2.5 V to 5.5 V	1.4 V to 5.5 V	0.5 μA Typ.(2 V)	—	—	32.768 kHz, 1 Hz	
RX-4575LC			1.6 V to 5.5 V	1.3 V to 5.5 V	0.35 μA Typ.(3 V)	—	Minute to Day	32.768 kHz	Built-in external event detection.
RX-4571LC/NB/SA			1.6 V to 5.5 V	1.1 V to 5.5 V	0.32 μA Typ.(3 V)	—	Minute to Day and day of the week	32.768 kHz to 1 Hz	LOW BACKUP VOLTAGE

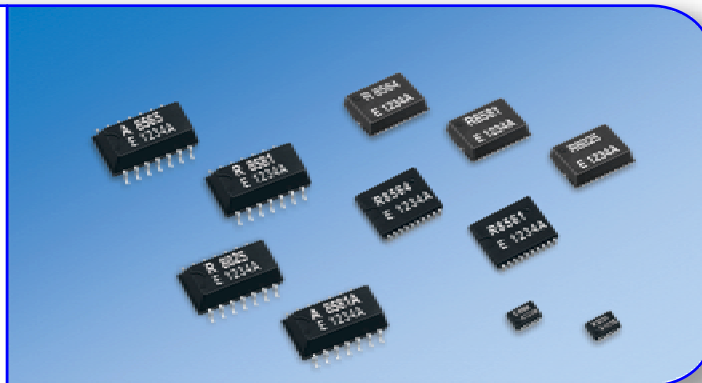
REAL TIME CLOCK MODULE

I²C-Bus


























●Features

- ▶ Compliant with I²C high-speed bus specifications.
- ▶ Built in frequency adjusted 32.768 kHz crystal unit.

* The I²C-Bus is a trademark of NXP Semiconductors.



I²C-Bus

Category	Model		Actual size (mm)		Features
I ² C Bus		RX-8025SA		10.1×7.4×3.2 t (Typ.)	High-Stability
		RX-8025NB		6.3×5.2×1.4 t (Max.)	
		RTC-8564JE		7.3×6.2×1.5 t (Max.)	Low power consumption
		RTC-8564NB		6.3×5.2×1.4 t (Max.)	
		RX-8564LC		3.6×2.8×1.2 t (Max.)	
		RA-8565SA		10.1×7.4×3.2 t (Typ.)	For Automotive
		RX-8571SA 		10.1×7.4×3.2 t (Typ.)	Low power consumption 128 bit User RAM Long-running timer (65000 hours)
		RX-8571NB 		6.3×5.2×1.4 t (Max.)	
		RX-8571LC 		3.6×2.8×1.2 t (Max.)	
		RX-8581SA		10.1×7.4×3.2 t (Typ.)	Simple Function
		RX-8581JE		7.3×6.2×1.5 t (Max.)	
		RX-8581NB		6.3×5.2×1.4 t (Max.)	
		RA-8581SA		10.1×7.4×3.2 t (Typ.)	For Automotive
		RX-8731LC		3.6×2.8×1.2 t (Max.)	Built-in EEPROM and Unique ID-ROM
		RX-8801SA 		10.1×7.4×3.2 t (Typ.)	Built-in DTCXO

► Specifications

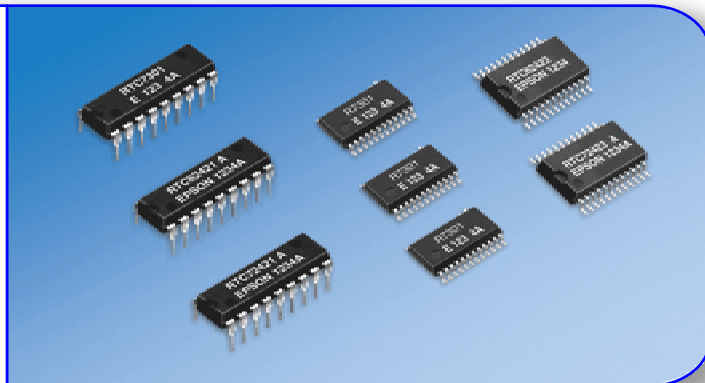
Item Model	Interface	Frequency tolerance (Standard)	Interface voltage	Clock voltage	Current consumption (Backup)	Memory	Alarm	Time interval of standard pulse	Other features
RX-8025 SA/NB	I ² C Bus	5±5 × 10 ⁻⁶ 0±5 × 10 ⁻⁶	1.7 V to 5.5 V	1.15 V to 5.5 V	0.48 μA Typ.(3 V)	—	Minute to Hour	32.768 kHz	High-Stability
RX-8564 LC		5±23 × 10 ⁻⁶	1.8 V to 5.5 V	1.0 V to 5.5 V	0.28 μA Typ.(3 V)	—	Minute to Day and day of the week	32.768 kHz to 1 Hz	Low power consumption
RTC-8564 JE/NB			1.8 V to 5.5 V	1.7 V to 5.5 V	0.55 μA Typ.(3 V)	—	Minute to Day and day of the week		Low power consumption
RA-8565SA			1.8 V to 5.5 V	1.7 V to 5.5 V	0.55 μA Typ.(3 V)	—	Minute to Day and day of the week	32.768 kHz to 1 Hz	For automotive
RX-8571SA/NB/LC			1.6 V to 5.5 V	1.3 V to 5.5 V	220 nA Typ.(3 V)	128 bit	Minute to Day and day of the week	32.768 kHz to 1 Hz	Low power consumption Long-running timer
RA-8581 SA			1.8 V to 5.5 V	1.6 V to 5.5 V	0.45 μA Typ.(3 V)	—	Minute to Day and day of the week	32.768 kHz	For automotive
RX-8581 SAJE			1.8 V to 5.5 V	1.6 V to 5.5 V	0.45 μA Typ.(3 V)	—	Minute to Day and day of the week	32.768 kHz	Simple Function
RX-8731LC			1.7 V to 5.5 V	1.3 V to 5.5 V	0.35 μA Typ.(3 V)	80 bit (EEPROM) 48 bit (ID-ROM)	Minute to Day and day of the week	32.768 kHz to 1 Hz	Built-in EEPROM and Unique ID-ROM
RX-8801SA		±5 × 10 ⁻⁶	1.8 V to 5.5 V	1.6 V to 5.5 V	0.8 μA Typ.(3 V)	—	Minute to Day and day of the week	32.768 kHz to 1 Hz	Built-in DTCXO

REAL TIME CLOCK MODULE







Parallel 4-bit

●Features

- ▶ Parallel interface.
- ▶ Built in frequency adjusted 32.768 kHz crystal unit.



■Parallel 4-bit

Category	Model	Actual size (mm)	Features
Parallel 4-bit	RTC-7301SF	 10.5×8.1×2.0 t (Max.)	Built-in Temperature Sensor
	RTC-7301DG	 DIP 18 pin	Available Alarm and Timer
	RTC-62421	 DIP 18 pin	4-bit Simple Function
	RTC-62423	 16.3×12.2×2.8 t (Max.)	
	RTC-72421	 DIP 18 pin	
	RTC-72423	 16.3×12.2×2.8 t (Max.)	

► Specifications

Item	Interface	Frequency tolerance (Standard)	Interface voltage	Clock voltage	Current consumption (Backup)	Memory	Alarm	Time interval of standard pulse	Other features
Model									
RTC-7301 SF/DG	4-bit Parallel	$5 \pm 23 \times 10^{-6}$	2.4 V to 5.5 V	1.6 V to 5.5 V	0.6 μ A Typ.(3 V)	—	Second to Day and day of the week	32.768 kHz to 1/30 Hz	High speed access 3V operation
RTC-62421		$\pm 10 \times 10^{-6}$ $\pm 50 \times 10^{-6}$	4.5 V to 5.5 V	2.0 V to 5.5 V	1.0 μ A Typ.(2 V)	—	—	64 Hz, 1 s, 1 min, 1 h	Intel bus
RTC-62423		$\pm 20 \times 10^{-6}$ $\pm 50 \times 10^{-6}$				—	—		
RTC-72421		$\pm 10 \times 10^{-6}$ $\pm 50 \times 10^{-6}$			0.9 μ A Typ.(2 V)	—	—		
RTC-72423		$\pm 20 \times 10^{-6}$ $\pm 50 \times 10^{-6}$				—	—		
RTC-72423		$\pm 20 \times 10^{-6}$ $\pm 50 \times 10^{-6}$				—	—		

Bits of knowledge

Frequency accuracy and clock accuracy

The expression for the accuracy in time measurement has the monthly deviation that shows how many seconds in a month.

Our real time clock module built in the oscillation circuit with the tuning fork crystal unit and report as frequency tolerance.

The calculation for transformation is simple. It is multiplied the second in a month by frequency tolerance.

For example

$$\text{Frequency tolerance } \pm 10 \times 10^{-6} : 30 \text{ days} \times 24 \text{ hours} \times 60 \text{ minutes} \times 60 \text{ seconds} \times 10 \times 10^{-6} \\ = \text{Equivalent to 30 seconds of monthly deviation}$$

Frequency tolerance	Monthly deviation (+25°C)	Model
$+5 \pm 5 \times 10^{-6}$	Equivalent to 13 seconds (+30seconds/-0 seconds)	RX-4045series, RX-8025series, RTC-7301series
$+5 \pm 23 \times 10^{-6}$	Equivalent to 1 minute (+1 minute 15 seconds/-45 seconds)	RX-4574series, RX-8564series, etc.
$0 \pm 5 \times 10^{-6}$	Equivalent to 13 seconds	RX-4045series, RX-8025series, RTC-7301series
$\pm 10 \times 10^{-6}$	Equivalent to 30 seconds	RTC-62421, RTC-72421
$\pm 20 \times 10^{-6}$	Equivalent to 1 minute	RTC-62423, RTC-72423
$\pm 50 \times 10^{-6}$	Equivalent to 2 minutes 15 seconds	RTC-62421, RTC-72421, RTC-62423, RTC-72423

Attentions; Temperature variation and power supply voltage variation are not considering.

The frequency by the temperature variation among the tuning fork crystal unit sets +5 offset value, because it becomes negative shifts.

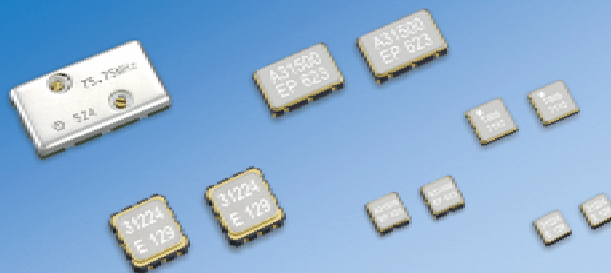


FILTER

Monolithic Crystal Filter (MCF) SAW Filter

•Features

- ▶ Wide selection of types according to application.
- ▶ Customer designs available upon request.
Please inquire it.



■Monolithic Crystal Filter (MCF)

▶ HF series

Applications	Frequency	Pole (Filter order)	Passband		Model	External dimension (mm)		
	MHz		kHz	dB				
Radio Equipment / IF (For miniature size Equipments)	130.05	2	±15	3	HF-232A		2.5 × 2.0 × 0.9 t	
	130.05	3	±15	3	HF-233A		3.0 × 3.0 × 0.9 t	
	122.88	2	±6	3	HF-362A		3.0 × 3.0 × 0.9 t	
	243	3	±10	3	HF-363A		3.8 × 3.8 × 1.0 t	
	61.44	2	±6	3	HF-372A		3.8 × 3.8 × 1.0 t	
Radio Equipment / IF	73.35	3	±6	3	HF-373A		7.0 × 5.0 × 1.1 t	
	73.35	4	±7.5	3	HF-734A		7.0 × 5.0 × 1.1 t	
Base Stations / IF (GSM)	71	4	±10	3	HF-J14A		18.3 × 10.3 × 2.8 t	
		4	±80	3	HF-S14A		26.0 × 16.0 × 5.0 t	

*Models for other frequencies are available upon request.

▶ MF series

Applications	Frequency	Pole (Filter order)	Passband		Model	External dimension (mm)		
	MHz		kHz	dB				
Radio Equipment / IF (For miniature size Equipments)	45	2	±7.5	3	MF-372A		3.8 × 3.8 × 1.0 t	
	130.05	3	±14	3	MF-373A		3.8 × 3.8 × 1.0 t	
Radio Equipment / IF	21.4	2	±7.5	3	MF-722A		7.0 × 5.0 × 1.0 t	
	21.7							
	45	2	±15	3	MF-723A		7.0 × 5.0 × 1.0 t	
	45	3	±15	3	MF-723A		7.0 × 5.0 × 1.0 t	
	45	4	±7.5	3	MF-734A		7.0 × 5.0 × 1.1 t	

*Models for other frequencies are available upon request.

■SAW Filter

Application		Nominal frequency (MHz)	Passband (MHz)	Model	External dimension		
					Actual size	Typ. (mm)	
TPMS, RKE/RF ARIB std. T67 in Japan / RF	RKE TPMS ARIB T67 	300 to 500	0.2	FF-555		5.2 × 4.8 × 1.5 t	
		300 to 500	0.4	FF-585		5.2 × 4.8 × 1.5 t	
		300 to 500	0.4(0.6)	FF-32N		3.8 × 3.8 × 0.98 t	
		300 to 450	0.6 to 4	TF-330A / C		3.0 × 3.0 × 1.11 t	
ISM/RF	Europ	869	2	TQS-557AA-7R		3.0 × 3.0 × 1.11 t	
GPS, Car navigation / RF		1575.42	2.4	TQS-949AD-7G		2.5 × 2.0 × 0.8 t	
W-LAN/IF		374	17	TQS-471BB-7R		3.0 × 3.0 × 1.11 t	
Cellular phone / IF	W-CDMA/UMTS	190	4.6	TQS-477AA-7R		3.0 × 3.0 × 1.11 t	
Base station / IF	W-CDMA Base Station	380	4.4	TQS-472BA-7R		7.0 × 5.0 × 1.5 t	

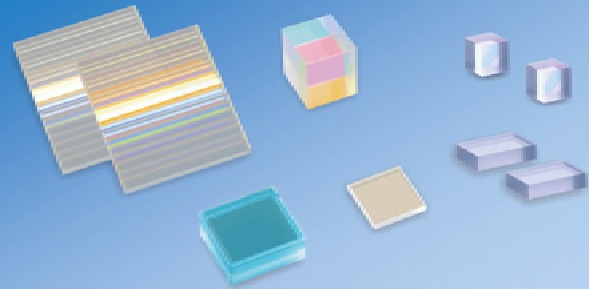
RKE : Remote Keyless Entry
TPMS : Tire Pressure Monitoring System



OPTICAL DEVICE

●Features

- ▶ Wide selection of types according to application.
- ▶ Customer designs available upon request.
Please inquire it.

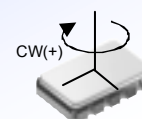
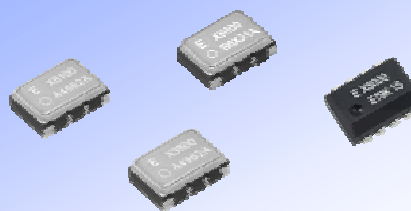


▶ Optical Device

Applications		Model	Wavelength (nm)	Optical Specification	Incident Angle (°)	Dimension (Ex.) (mm)
Optical Pickup	DVD CD	1/4 Wave plate C type (Single plate)	660 or 785	Phase retardation: 90° ± 5° (0° Incident angle)	0° ± 0.5°	□4 t: DVD: 0.35 CD: 0.45
		1/4 Wave plate D type (Double plate)			0° ± 5°	□4 t: DVD: 1.1 CD: 1.1
		1/4 Wave plate G type (Double plate)			0° ± 5°	□4 t: DVD: 0.55 CD: 0.7
		1/2 Wave plate C type (Single plate)		Phase retardation: 180° ± 5° (0° Incident angle)	0° ± 0.5°	□4 t: DVD: 0.7 CD: 0.85
		1/2 Wave plate D type (Double plate)			0° ± 5°	□4 t: DVD: 1.1 CD: 1.1
		1/2 Wave plate G type (Double plate)			0° ± 5°	□4 t: DVD: 0.7 CD: 0.7
	Blue	1/4 Wave plate C type (Single plate)	405	Phase retardation: 90° ± 5° (0° Incident angle)	0° ± 0.5°	□4 × 0.3
		1/4 Wave plate D type (Double plate)			0° ± 5°	□4 × 0.6
		1/2 Wave plate D type (Double plate)		Phase retardation: 180° ± 5° (0° Incident angle)	0° ± 5°	□4 × 0.6
	DVD CD	Dichroic Prism DVD penetrate type	660	Tp ≥ 90 % Ts ≥ 90 % (0° Incident angle)	0° ± 5°	3 × 3 × 3
			785	Rp ≥ 88 % Rs ≥ 92 % (0° Incident angle)		
		Dichroic Prism DVD reflection type	660	Rp ≥ 80 % Rs ≥ 97 % (0° Incident angle)	0° ± 5°	3 × 3 × 3
			785	Tp ≥ 94 % Ts ≥ 94 % (0° Incident angle)		
	Blue	PBS Prism	405	Tp ≥ 93 % Rs ≥ 90 % (0° Incident angle)	0° ± 6°	3 × 3 × 3
	Blue DVD CD	Trichroic Prism	405	Rp ≥ 84 % Rs ≥ 93 % (0° Incident angle)	0° ± 6°	4 × 4 × 4
			660	Tp ≥ 93 % Ts ≥ 93 % (0° Incident angle)		
			785	Tp ≥ 94 % Ts ≥ 94 % (0° Incident angle)		
	Blue DVD CD	Grating	405 or 660 or 785	Grating ratio=1:10:1 Grating pitch 20 μm	0°	3 × 2 × 0.5
	DVD CD	Dichroic Filter	660, 785	Peripheral 660 nm T ≥ 95 % 785 nm T ≤ 5 % Center 660 nm T ≥ 95 % 785 nm T ≥ 95 %	0°	4 × 4 × 0.5
Camera (Cellular)	DSC DVC	OLPF IR-cut Filter	400 to 1200	50 % Wavelength 650 nm ± 10 nm	0°	8 × 7
		OLPF UV-IRcut-Filter	410 to 1200	50 % Wavelength UV: 410 nm ± 10 nm 50 % Wavelength IR: 650 nm ± 10 nm		
	DSLR	OLPF 4 points separation	400 to 1200	50 % Wavelength UV: 410 nm ± 10 nm 50 % Wavelength IR: 650 nm ± 10 nm	0°	22 × 28
Projector	3LCD	PS Converter	420 to 680	Tp ≥ 94 % Rs ≥ 95 % (0° Incident angle)	0°	34.6 × 35 × 4.2
		Heat Sink Plate	420 to 680	1 % Max. (0° Incident angle)	0°	23.5 × 20
Optical Network	Infra-structure	Etalon Filter	1520 to 1610	FSR 50 GHz	0°	

**GYRO SENSOR****XV series**

- Ultra Small Package size SMD (5 × 3.2 × 1.3 mm)
- Hermetic sealing provides excellent sustainable environmental capability.
- High stability using vibration crystal.

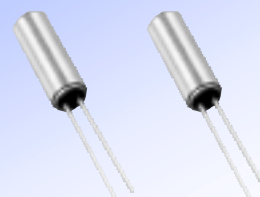


► Gyro sensor

Model	Operating Voltage	Reference Voltage	Detection Range	Scale Factor	Non Linearity	Operating Temperature	Recommended Application
XV-8000LK	4.75 to 5.25 V	50 % V _{DD}	±60 deg/s	25 mV/deg/s	±0.5 %FS	-40 °C to +85 °C	Car navigation system
XV-8000CB	4.75 to 5.25 V	50 % V _{DD}	±60 deg/s	25 mV/deg/s	±0.5 %FS	-40 °C to +85 °C	Car navigation system
XV-8100CB	2.85 to 3.15 V	1350 mV	±100 deg/s	2.50 mV/deg/s	±0.5 %FS	-40 °C to +85 °C	Portable type GPS,PND
XV-3500CB	2.7 to 3.3 V	1350 mV	±100 deg/s	0.67 mV/deg/s	±5 %FS	-20 °C to +80 °C	Detection picture stabilization

TEMPERATURE SENSING CRYSTAL**HTS-206**

- 2 mm in diameter and 6 mm in length.
- Good linearity frequency and temperature.
- Low frequency (40 kHz) enables low current consumption.
- Wide temperature range (-40 °C to +85 °C).
- Suitable for DTCXO and temperature equipment.

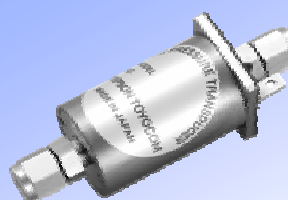


► Temperature Sensing Crystal

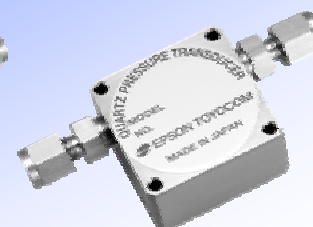
Model	Frequency Tolerance	Temperature coefficient			Motional resistance	Operating Temperature
		1st.	2ed.	3rd.		
HTS-206	±2 %	-26.0 × 10 ⁻⁶ / °C	-5.8 × 10 ⁻⁸ / °C ²	-1.5 × 10 ⁻¹⁰ / °C ³ Max.	30 kΩ Max.	-40 °C to +85 °C

QUARTZ PRESSURE SENSOR**TSU series**

- High precision and high resolution and accuracy
- Excellent repeatability with minimal hysteresis
- High stability against temperature variation
- Output frequency is unaffected by IN/OUT cable length.
- Applications : Various kinds of pressure measurement for industrial use
Water level measurement of dam, river, reservoir.



TSU-10GL



TSU-20G/70G/100G










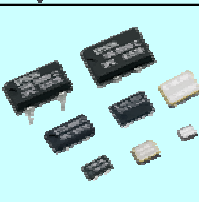















► Quartz Pressure Sensor

Model	Pressure measurement range	Linearity after linearization	Accuracy (Linearity, Repeatability, Hysteresis)	Operating Temperature	Operating humidity
TSU-10GL	0 to 100 kPa	0.1 % FS Max.	0.113 % FS Max.	-10 °C to +70 °C	0 % to 90 %
TSU-20G	0 to 200 kPa	0.01 % FS Max.	0.023 % FS Max.		
TSU-70G	0 to 700 kPa				
TSU-100G	0 to 1 MPa				



NEW products information

Introduce of the new products (New), Prepare for mass production (Preliminary), under development and miniature size products. (Some other products data sheet pages are providing Epson Toyocom home page.)

Model Name	Actual size	●Application ◆Features		
kHz Range Crystal Unit FC-125		● Clock ,Sub Clock ◆ Low profile, 32.768 kHz	NEW	Page. 24
kHz Range Crystal Unit FC-13E		● Clock,Sub Clock ◆ Low profile, 32.768 kHz	NEW	Page. 25
MHz Range Crystal Unit FA-118T		● Many reference clock,I/F clock,Video clock ◆ Ultra miniature "1612" size, High stability	PRELIMINARY	Page. 26
SPXO SG-150 **E		● RF Clock of wireless LAN, Bluetooth. ◆ Ultra miniature "2016" size, High stability, Low current consumption.	NEW	Page. 27
SPXO SG-211 **E		● RF Clock of wireless LAN, Bluetooth. ◆ Miniature "2520" size, High stability, Low current consumption.	NEW	Page. 28
SPXO SG-210 **D		● Clock. ◆ Miniature "2520" size, High stability ,Low current consumption.	PRELIMINARY	Page. 29
SPXO SG-210 series		● Clock. ◆ Miniature "2520" size, High stability ,Low current consumption.		Page. 30
SPXO SG-770SDD		● Clock. ◆ High frequency, High stability	NEW	Page. 31
SPXO SG-771PCD		● Clock. ◆ High frequency, High stability	NEW	Page. 32
SPXO SG-8003 series		● Clock. ◆ Programmable type, Low current consumption.	NEW	Page. 33 Page. 34
VCXO VG-4231CB VG-4531CB		● Video clock, Wire and Wireless equipments. ◆ Wide pull range	NEW	Page. 35
VCXO VG-4502CA		● Video clock, Wire and Wireless equipments. ◆ Wide pull range	NEW	Page. 36
VCXO VG-4511CA		● Video clock, Wire and Wireless equipments. ◆ Wide pull range	NEW	Page. 37
TCXO(VC-TCXO) TG-5021BA		● RF Clock ◆ Ultra miniature "2016" size, High reliability	NEW	Page. 38
OCXO OX-6501GG		● Base station ◆ SC-Cut Crystal unit ,Guarantee long term stability	PRELIMINARY	Page. 39
OCXO OX-6502GG		● Base station ◆ SC-Cut Crystal unit ,Guarantee long term stability	PRELIMINARY	Page. 40
OCXO OX-6601DL		● Base station ◆ SC-Cut Crystal unit ,Guarantee long term stability	NEW	Page. 41
Rubidium atomic oscillator Rb-3310N		● Enhanced digital multiplexer ◆ Excellent high stability	NEW	Page. 42
Rubidium atomic oscillator Rb-2110CB		● Enhanced digital multiplexer ◆ Excellent frequency stability, 1PPS synchronization type.	NEW	Page. 43
Real Time Clock Module RA-4565SA		● For automotive ◆ Serial 4-Wire ,Wide operating temperature range. (-40 °C to +125 °C)	NEW	Page. 44
Real Time Clock Module RX-4801SA		● ◆ Serial 4-Wire ,Built-in 32kHz-DTCXO ,High stability	NEW	Page. 45
Real Time Clock Module RX-8801SA		● ◆ I ² C-Bus, Built-in 32kHz-DTCXO ,High stability	NEW	Page. 46
Real Time Clock Module RX-8571series		● ◆ I ² C-Bus, Low current consumption,128 bit User RAM ,65535 hours timer	NEW	Page. 47
Gyro Sensor XV-8000LK		● For car navigation system (V _{DD} =5.0 V) ◆ High stability using vibration crystal ,Inclined type	NEW	Page. 48
OLPF 4 points separation		● Digital single lens reflex camera (DSLR) ◆ Good separation performance ,smaller and slim in size	NEW	Page. 49



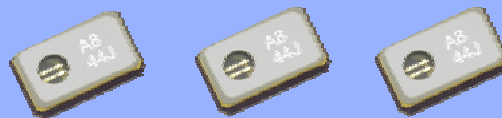
kHz RANGE CRYSTAL UNIT LOW PROFILE SMD

FC-125

- Frequency range : 32.768 kHz
- Thickness : 0.7 mm Max.
- Overtone order : Fundamental
- Applications : Small communications devices



Product Number (please contact us)
X1A000011xxxx00



Actual size



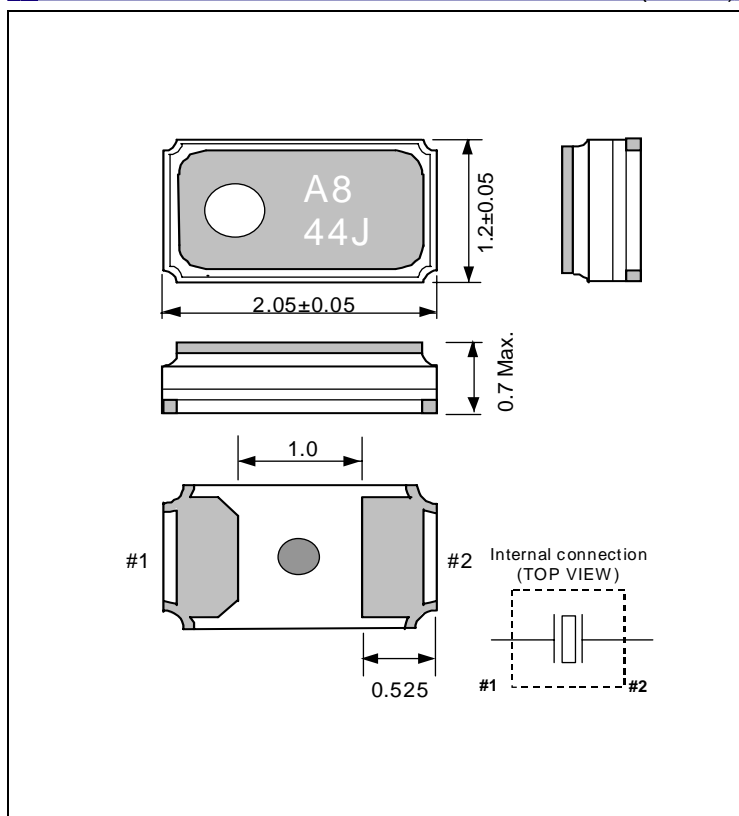
NEW

Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Nominal frequency range	f_nom	32.768 kHz	
Temperature range	Storage temperature	T_stg	-55 °C to +125 °C
	Operating temperature	T_use	-40 °C to +85 °C
Level of drive	DL	0.5 μW Max.	
Frequency tolerance (standard)	f_tol	$\pm 10 \times 10^{-6}$ $\pm 20 \times 10^{-6}$	+25 °C, DL=0.1 μW
Turnover temperature	Ti	+25 °C \pm 5 °C	
Parabolic coefficient	B	$-0.04 \times 10^{-6} / ^\circ\text{C}^2$ Max.	
Load capacitance	CL	12.5 pF	
Motional resistance (ESR)	R1	90 kΩ Max.	
Motional capacitance	C1	6.4 fF Typ.	
Shunt capacitance	C0	1.3 pF Typ.	
Frequency aging	f_age	$\pm 3 \times 10^{-6} / \text{year}$ Max.	+25 °C, First year

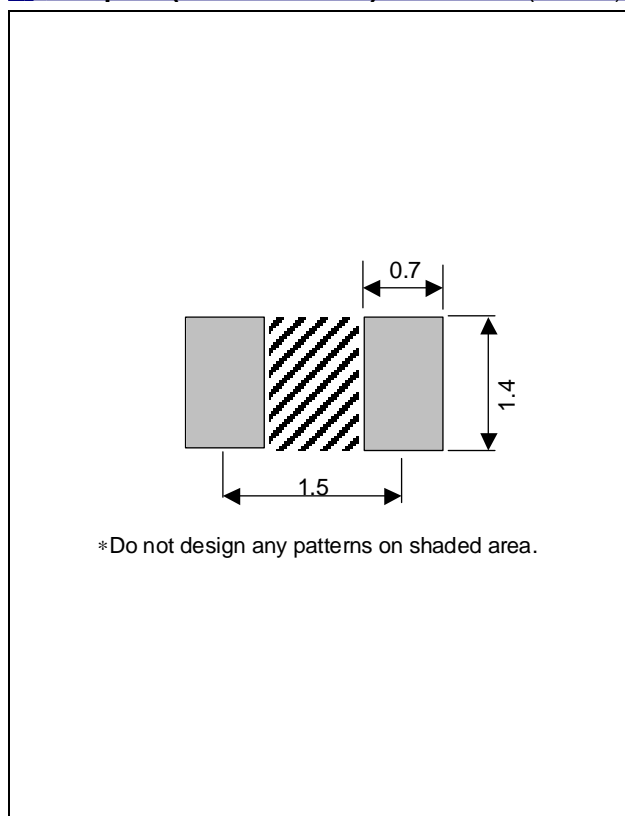
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





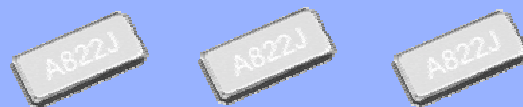
kHz RANGE CRYSTAL UNIT LOW PROFILE SMD

FC-13E

- Frequency range : 32.768 kHz
- Thickness : 0.48 mm Max.
- Overtone order : Fundamental
- Applications : Small communications devices
Smart Card



Product Number (please contact us)
X1A000041xxxx00



Actual size

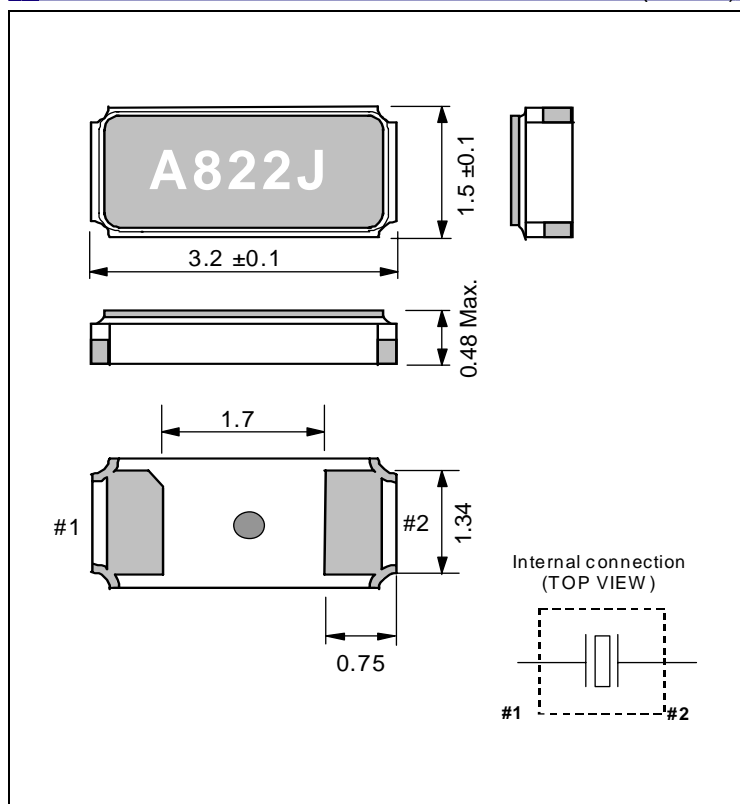


Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Nominal frequency range	f_nom	32.768 kHz	
Temperature range	Storage temperature	T_stg	-55 °C to +125 °C
	Operating temperature	T_use	-40 °C to +85 °C
Level of drive	DL	0.5 μW Max.	
Frequency tolerance (standard)	f_tol	$\pm 100 \times 10^{-6}$	+25 °C, DL=0.1 μW Please ask tighter for tolerance
Turnover temperature	Ti	+25 °C ± 5 °C	
Parabolic coefficient	B	$-0.04 \times 10^{-6} / ^\circ\text{C}^2$ Max.	
Load capacitance	CL	9 pF, 12.5 pF	Please specify
Motional resistance (ESR)	R1	75 kΩ Max.	
Motional capacitance	C1	3.4 fF Typ.	
Shunt capacitance	C0	1.0 pF Typ.	
Frequency aging	f_age	$\pm 3 \times 10^{-6} / \text{year}$ Max.	+25 °C, First year

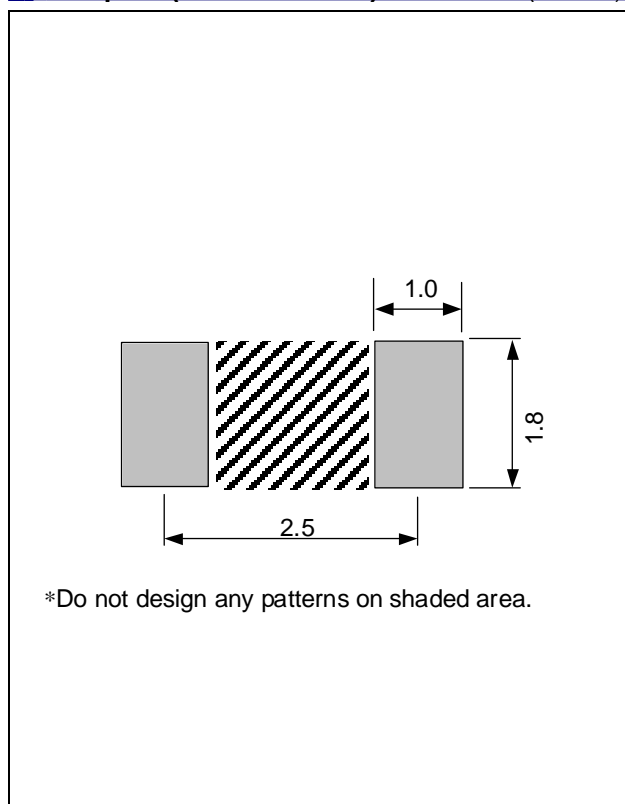
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





MHz RANGE CRYSTAL UNIT

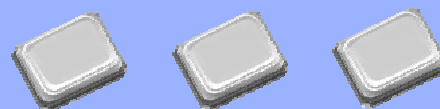
ULTRA MINIATURE SIZE LOW PROFILE SMD

FA-118T

- Nominal frequency range : 30 MHz to 54 MHz
- Thickness : 0.35mm Max.
- Overtone order : Fundamental
- Applications : Mobile phone, Bluetooth, W-LAN
ISM band radio, Clock for MPU



Product Number (please contact us)
X12000251xxxx00



Actual size

PRELIMINARY

Specifications (characteristics)

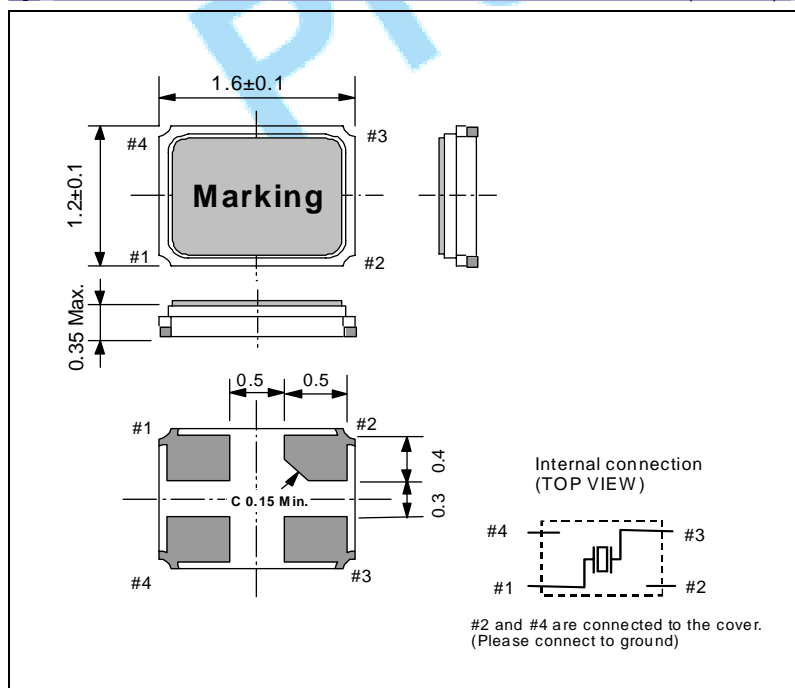
Item	Symbol	Specifications		Remarks
		For RF Reference	For Clock	
Nominal frequency range	f _{nom}	30.000 MHz to 54.000 MHz		Fundamental Please contact us for inquiries regarding the available frequencies.
Storage temperature range	T _{stg}	-40 °C to +125 °C		Store as bare product after unpacking
Operating temperature range	T _{use}	-40 °C to +85 °C		
Level of drive	DL	50 µW Max.	100 µW Max.	
Frequency tolerance (standard)	f _{tol}	±10 × 10 ⁻⁶	±30 × 10 ⁻⁶	+25 °C For the out of standard specifications, please contact us for inquiries.
Frequency versus temperature characteristics (standard)	f _{tem}	±10 × 10 ⁻⁶	±30 × 10 ⁻⁶	-20 °C to +75 °C For the out of standard specifications, please contact us for inquiries.
Load capacitance	CL	8 pF to ∞		Please specify.
Motional resistance (ESR)	R ₁	As per below table		-20 °C to +75 °C
Frequency aging	f _{age}	±1 × 10 ⁻⁶ / year Max.	±5 × 10 ⁻⁶ / year Max.	+25 °C, First year

Motional resistance (ESR)

Frequency	Motional resistance
30.0 MHz ≤ f _{nom} ≤ 32.0 MHz	200 Ω Max.
32.0 MHz < f _{nom} < 36.0 MHz	100 Ω Max.
36.0 MHz ≤ f _{nom} ≤ 54.0 MHz	60 Ω Max.

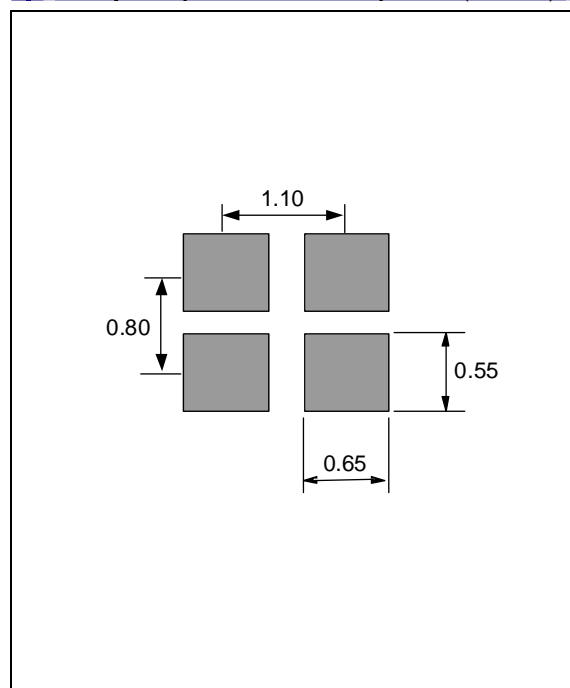
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR

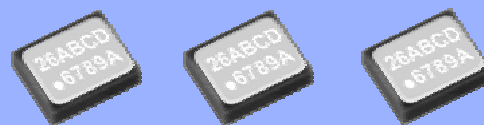
Low Profile / High stability SPXO

SG - 150S*E

- Frequency range : 3.000 MHz to 54.000 MHz
- Supply voltage : 1.8 V Typ. or 2.5 V Typ. or 3.3 V Typ.
- Current consumption : 3.3 mA Max.
(SEE 1.8 V No load condition 40 MHz)
- Function : Standby(ST)
- Thickness : 0.75 mm Typ.



Product Number (please contact us)



Actual size

NEW

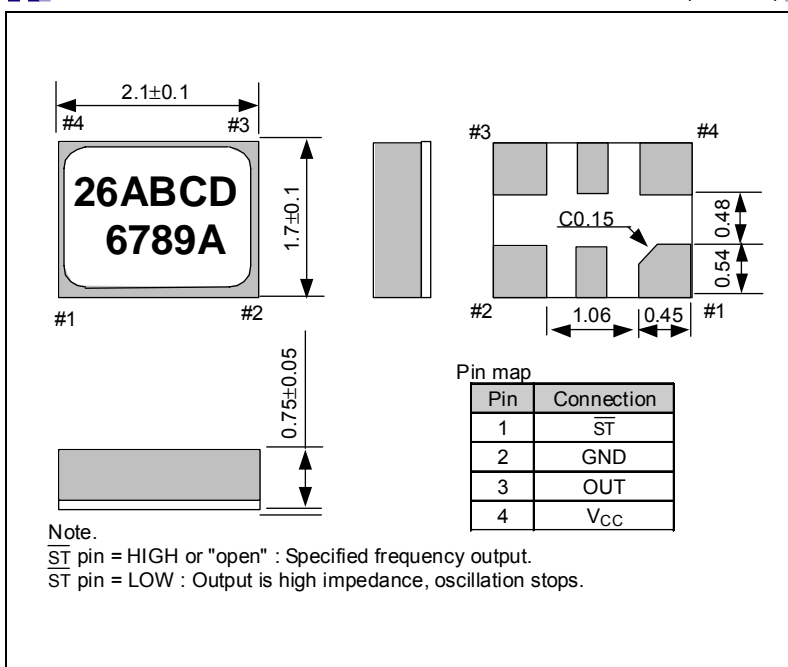
Specifications (characteristics)

Item		Symbol	Specifications			Remarks	
			SG-150SEE	SG-150SDE	SG-150SCE		
Output frequency range		f ₀	3.000 MHz to 54.000 MHz			Please contact us for inquiries regarding the available frequencies.	
Supply voltage		V _{CC}	1.8 V Typ. 1.6 V to 2.2 V	2.5 V Typ. 2.2 V to 2.7 V	3.3 V Typ. 2.7 V to 3.6 V		
Temperature range	Storage temperature	T _{stg}	-40 °C to +85 °C			Store as bare product after unpacking	
	Operating temperature	T _{use}	-40 °C to +85 °C				
Frequency tolerance *		f _{tol}	D: ±20 × 10 ⁻⁶ , E: ±15 × 10 ⁻⁶			-20 °C to +70 °C	V _{CC} ±10%
			H: ±20 × 10 ⁻⁶ , T: ±15 × 10 ⁻⁶			-40 °C to +85 °C	
Current consumption		I _{CC}	2.3 mA Max.	2.5 mA Max.	3.5 mA Max.	No load condition, 3 MHz ≤ f ₀ ≤ 32 MHz	
			2.8 mA Max.	3.0 mA Max.	4.0 mA Max.	No load condition, 32 MHz < f ₀ ≤ 40 MHz	
			3.3 mA Max.	3.5 mA Max.	4.5 mA Max.	No load condition, 40 MHz < f ₀ ≤ 48 MHz	
			4.5 mA Max.	5.0 mA Max.	6.0 mA Max.	No load condition, 48 MHz < f ₀ ≤ 54 MHz	
Stand-by current		I _{std}	5.0 μA Max.			ST = GND	
Symmetry		SYM	45 % to 55 %			50 % V _{CC} level, L _{CMOS} ≤ 15 pF	
High output voltage		V _{OH}	90 % V _{CC} Min.			I _{OH} = 4 mA	
Low output voltage		V _{OL}	10 % V _{CC} Max.			I _{OL} = 4 mA	
Output load condition (CMOS)		L _{CMOS}	15 pF Max.				
Output enable / disable input voltage		V _{IH}	80 % V _{CC} Min.			ST terminal	
		V _{IL}	20 % V _{CC} Max.				
Rise time / Fall time		t _r / t _f	4.5 ns Max.			20 % V _{CC} to 80 % V _{CC} level, L _{CMOS} = 15 pF	
Start-up time		t _{str}	5 ms Max.			t = 0 at 90 % V _{CC}	
Frequency aging		f _{aging}	This is included Frequency tolerance			+25 °C, First year, V _{CC} = 1.8 V, 2.5 V, 3.3 V	

* Please contact us for inquiries regarding available frequency tolerance.

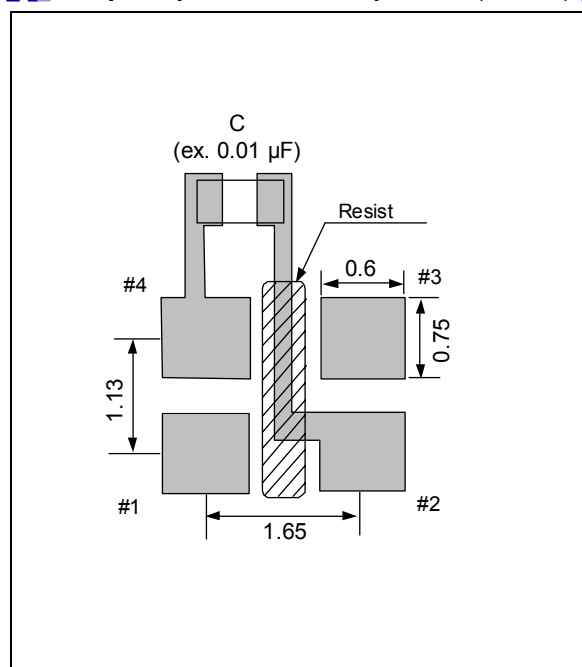
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR

Low Profile / High stability SPXO

SG-211S*E

- Frequency range : 2.375 MHz to 60.000 MHz
- Supply voltage : 1.8 V Typ. or 2.5 V Typ. or 3.3 V Typ.
- Current consumption : 3.3 mA Max.
(SEE 1.8 V No load condition 40 MHz)
- Function : Standby(\overline{ST})
- Thickness : 0.7 mm Typ.



Product Number (please contact us)



Actual size

**NEW**

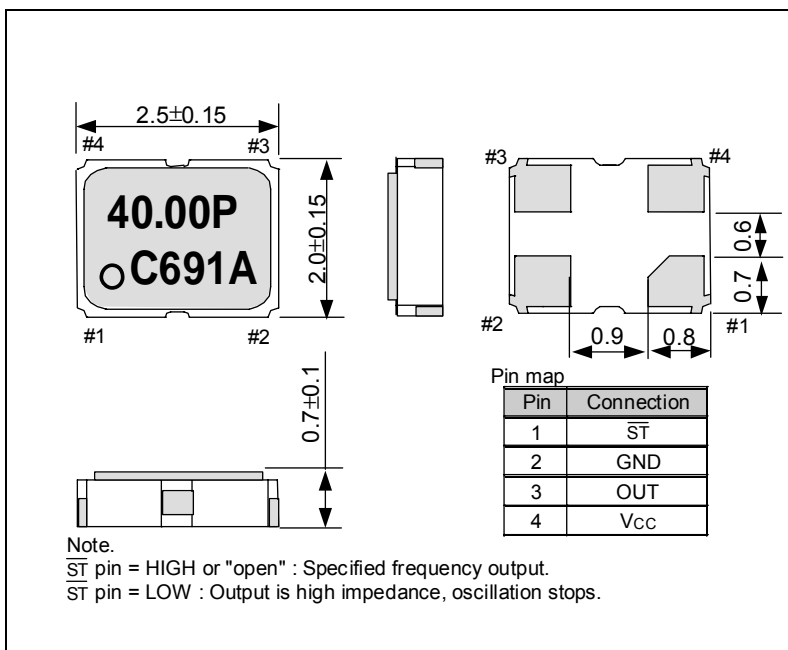
Specifications (characteristics)

Item		Symbol	Specifications			Remarks	
			SG-211SEE	SG-211SDE	SG-211SCE		
Output frequency range		f ₀	2.375 MHz to 60.000 MHz			Please contact us for inquiries regarding the available frequencies.	
Supply voltage		V _{CC}	1.8 V Typ. 1.6 V to 2.2 V	2.5 V Typ. 2.2 V to 2.7 V	3.3 V Typ. 2.7 V to 3.6 V		
Temperature range	Storage temperature	T _{stg}	-40 °C to +125 °C			Store as bare product after unpacking	
	Operating temperature	T _{use}	-40 °C to +85 °C				
Frequency tolerance *		f _{tol}	D: ±20 × 10 ⁻⁶ , E: ±15 × 10 ⁻⁶			-20 °C to +70 °C	V _{CC} ±10%
			H: ±20 × 10 ⁻⁶ , T: ±15 × 10 ⁻⁶			-40 °C to +85 °C	
Current consumption		I _{CC}	2.3 mA Max.	2.5 mA Max.	3.5 mA Max.	No load condition, 2.375 MHz≤f ₀ ≤32 MHz	
			2.8 mA Max.	3.0 mA Max.	4.0 mA Max.	No load condition, 32 MHz<f ₀ ≤40 MHz	
			3.3 mA Max.	3.5 mA Max.	4.5 mA Max.	No load condition, 40 MHz<f ₀ ≤48 MHz	
			4.5 mA Max.	5.0 mA Max.	6.0 mA Max.	No load condition, 48 MHz<f ₀ ≤60 MHz	
Stand-by current		I _{std}	5.0 μA Max.			ST =GND	
Symmetry		SYM	45 % to 55 %			50 % V _{CC} level, L _{CMOS} ≤ 15 pF	
High output voltage		V _{OH}	90 % V _{CC} Min.			I _{OH} = -4 mA	
Low output voltage		V _{OL}	10 % V _{CC} Max.			I _{OL} = 4 mA	
Output load condition (CMOS)		L _{CMOS}	15 pF Max.				
Output enable / disable input voltage		V _{IH}	80 % V _{CC} Min.			ST terminal	
		V _{IL}	20 % V _{CC} Max.				
Rise time / Fall time		t _r / t _f	4.5 ns Max.			20 % V _{CC} to 80 % V _{CC} level, L _{CMOS} =15 pF	
Start-up time		t _{str}	5 ms Max.			t=0 at 90 % V _{CC}	
Frequency aging		f _{aging}	This is included frequency tolerance			+25 °C, First year, V _{CC} = 1.8 V, 2.5 V, 3.3 V	

* Please contact us for inquiries regarding available frequency tolerance.

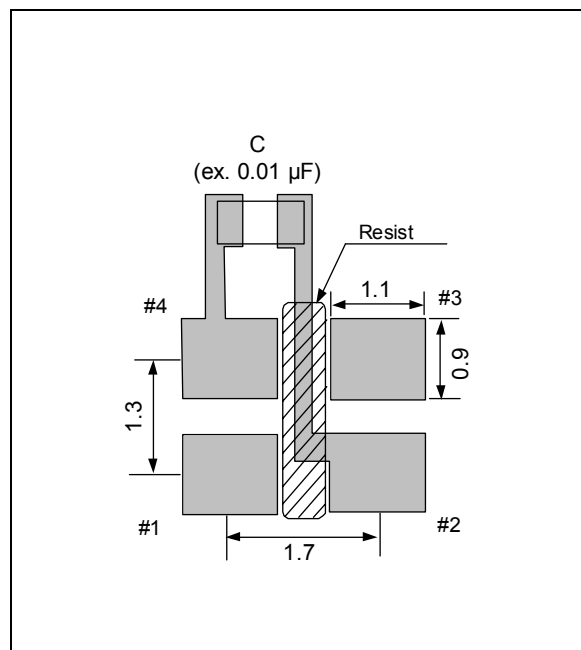
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR

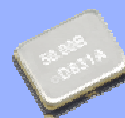
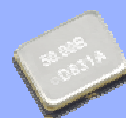
Low Profile / LOW-JITTER SPXO

SG-210S*D

- Frequency range : 50.000 MHz to 80.000 MHz
- Supply voltage : 1.8 V Typ. or 2.5 V Typ. or 3.3 V Typ.
- Current consumption : 7.0 mA Max.
(SDD 2.5 V No load condition 80 MHz)
- Function : Standby($\overline{\text{ST}}$)
- Thickness : 0.8 mm Typ.



Product Number (please contact us)



Actual size

**PRELIMINARY**

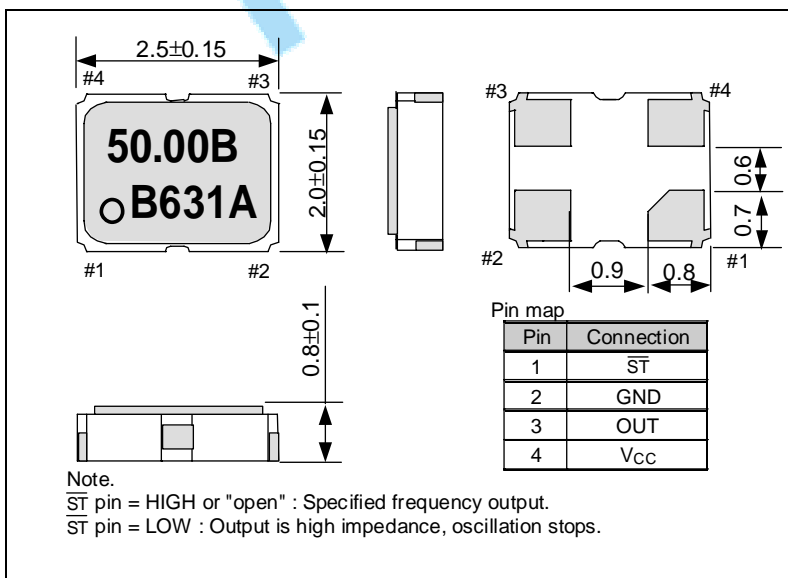
Specifications (characteristics)

Item		Symbol	Specifications			Remarks
			SG-210SED	SG-210SDD	SG-210SCD	
Output frequency range		f ₀	50.000 MHz to 80.000 MHz			
Supply voltage		V _{cc}	1.8 V Typ. 1.6 V to 2.2 V	2.5 V Typ. 2.2 V to 3.0 V	3.3 V Typ. 2.7 V to 3.6 V	
Temperature range	Storage temperature	T _{stg}	-40 °C to +125 °C			Store as bare product after unpacking
	Operating temperature	T _{use}	-40 °C to +85 °C			
Frequency tolerance *		f _{tol}	B: ±50 × 10 ⁻⁶ , C: ±100 × 10 ⁻⁶			-20 °C to +70 °C
			L: ±50 × 10 ⁻⁶ , M: ±100 × 10 ⁻⁶			-40 °C to +85 °C
Current consumption		I _{cc}	6.0 mA Max.	7.0 mA Max.	8.0 mA Max.	No load condition
Stand-by current		I _{std}	10.0 μA Max.			ST =GND
Symmetry		SYM	45 % to 55 %			50 % V _{cc} level,L _{CMOS} ≤ 30 pF
High output voltage		V _{OH}	V _{cc} -0.4 V Min.			I _{OH} =8 mA(SCD,SDD), -4 mA(SED)
Low output voltage		V _{OL}	0.4 V Max.			I _{OL} = 8 mA(SCD,SDD), 4 mA(SED)
Output load condition (CMOS)		L _{CMOS}	30 pF Max.			
Output enable / disable input voltage		V _{IH}	70 % V _{cc} Min.			ST terminal
		V _{IL}	30 % V _{cc} Max.			
Rise time / Fall time		t _r / t _f	4 ns Max.			20 % V _{cc} to 80 % V _{cc} level, L _{CMOS} ≤ 30 pF
Start-up time		t _{str}	2 ms Max.			t=0 at 90 % V _{cc}
Jitter *1		t _{DJ}	0.5 ps Typ.			Deterministic Jitter
		t _{RJ}	3.0 ps Typ.			Random Jitter
		t _{RMS}	25 ps Typ.			Peak to Peak
Phase Jitter		t _{PJ}	1.0 ps Max.			Offset frequency: 12 kHz to 20 MHz
Frequency aging		f _{aging}	±3 × 10 ⁻⁶ / year Typ.			+25 °C, First year, V _{cc} = 1.8 V, 2.5 V, 3.3 V
			±10 × 10 ⁻⁶ / 10 years Typ.			+25 °C, 10 years, V _{cc} = 1.8 V, 2.5 V, 3.3 V

*1 Based on DTS-2075 Digital timing system made from WAVECREST with jitter analysis software VISI6.

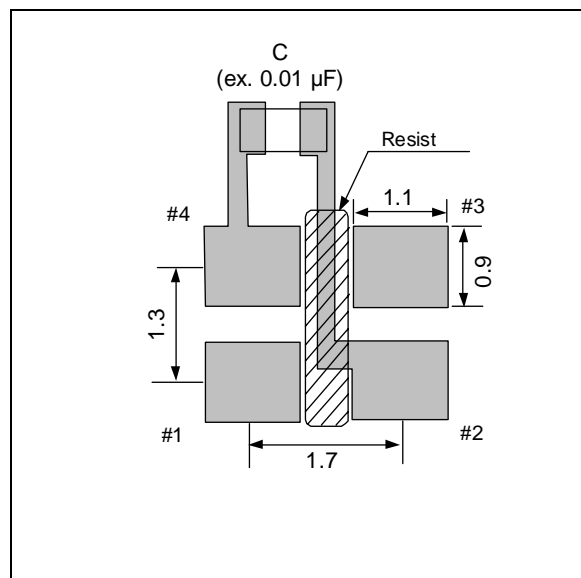
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR SPXO

SG-210 series

- Frequency range : 2 MHz to 48 MHz
- Supply voltage : 1.5 V Typ. / 1.8 V Typ. / 2.5 V Typ. / 3.3 V Typ.
- Current consumption : 0.9 mA Typ.
(SEB 1.8 V No load condition 48 MHz)
- Function : Standby(\overline{ST})
- Thickness : 0.8 mm Typ.
- Operation temperature : +105 °C / +125 °C



Product Number (please contact us)
Q33210Bx0xxxx00



Actual size

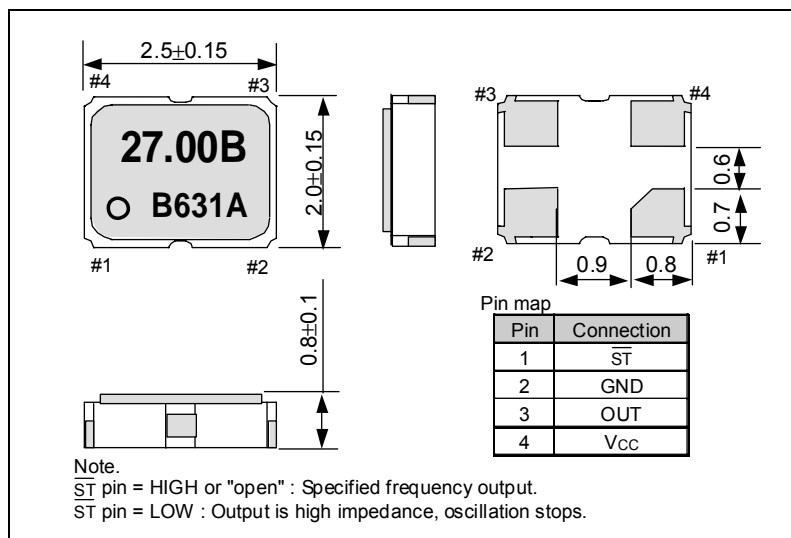


Specifications (characteristics)

Item		Symbol	Specifications				Remarks	
			SG-210SGB	SG-210SEB	SG-210SDB	SG-210SCB		
Output frequency range		f ₀	2 MHz to 32 MHz	2 MHz to 48 MHz				
Supply voltage		V _{CC}	1.5 V Typ. 1.3 V to 1.7 V	1.8 V Typ. 1.6 V to 2.2 V	2.5 V Typ. 2.2 V to 3.0 V	3.3 V Typ. 2.7 V to 3.6 V		
Temperature range	Storage temperature	T _{stg}	-40 °C to +125 °C				Store as bare product after unpacking	
	Operating temperature	T _{use}	-40 °C to +85 °C / -40 °C to +105 °C / -40 °C to +125 °C					
Frequency tolerance		f _{tol}	F: ±20 × 10 ⁻⁶				-10 °C to +60 °C, f ₀ ≤ 32 MHz, V _{CC} ±10%, except reflow drift.	
			B: ±50 × 10 ⁻⁶ , C: ±100 × 10 ⁻⁶				-20 °C to +70 °C	
			L: ±50 × 10 ⁻⁶ , M: ±100 × 10 ⁻⁶				-40 °C to +85 °C	
			—	Y: ±50 × 10 ⁻⁶ , W: ±100 × 10 ⁻⁶			-40 °C to +105 °C	
			—	Z: ±100 × 10 ⁻⁶ , X: ±150 × 10 ⁻⁶			-40 °C to +125 °C	
Current consumption		I _{CC}	1.0 mA Max.	1.6 mA Max.	2.4 mA Max.	3.0 mA Max.	No load condition	
			—	2.0 mA Max	3.0 mA Max.	4.0 mA Max.	No load condition +105 °C, +125 °C	
Stand-by current		I _{std}	0.3 µA Max.	0.5 µA Max.	1.0 µA Max.	1.0 µA Max.	ST =GND	
			—	1.6 µA Max.	2.4 µA Max.	3.0 µA Max.	ST =GND +105 °C, +125 °C	
Symmetry		SYM	45 % to 55 %	45 % to 55 %	45 % to 55 %	45 % to 55 %	2 MHz≤f ₀ ≤16 MHz	50 % V _{CC} level L _{CMOS} ≤ 15 pF
			40 % to 60 %				16 MHz<f ₀ ≤32 MHz	
			—				32 MHz<f ₀ ≤48 MHz	
			—				40 % to 60 %	
High output voltage		V _{OH}	90 % V _{CC} Min.				I _{OH} =-1 mA	
Low output voltage		V _{OL}	10 % V _{CC} Max.				I _{OL} = 1 mA	
Output load condition (CMOS)		L _{CMOS}	15 pF Max.					
Output enable / disable input voltage		V _{IH}	80 % V _{CC} Min.				ST terminal	
		V _{IL}	20 % V _{CC} Max.					
Rise time and Fall time		t _r / t _f	5 ns Max.	4 ns Max.	3 ns Max.		+85 °C	20 % V _{CC} to 80 % V _{CC} level, L _{CMOS} =15 pF
			—	7ns Max			+105 °C, +125 °C	
Start-up time		t _{str}	3 ms Max.				t=0 at 90 % V _{CC} (+105°C, +125 °C : 5 ms Max.)	
Frequency aging		f _{aging}	±3 × 10 ⁻⁶ / year Max.				+25 °C, First year, V _{CC} =1.5V, 1.8 V, 2.5 V, 3.3 V	

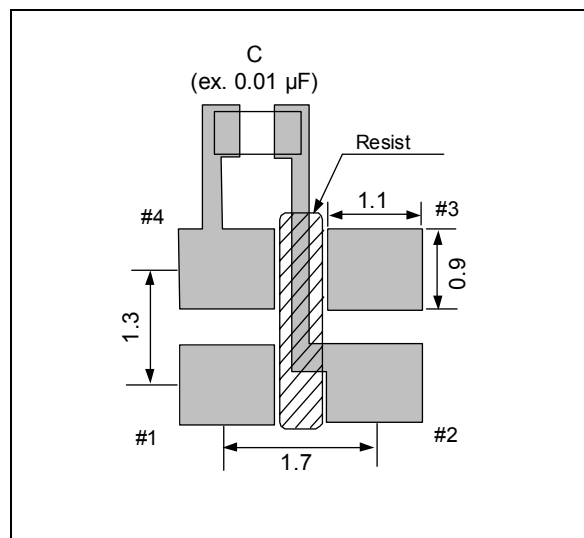
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





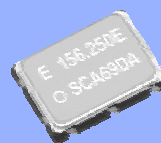
CRYSTAL OSCILLATOR SPXO

SG-770 series

- Frequency range : 50 MHz to 230 MHz
- Supply voltage : 2.5 V or 3.3 V
- Output : LV-PECL
- Thickness : 1.6 mm Typ.
- Features : Fundamental mode oscillator with HFF-XTAL
- Function : Standby (\overline{ST})
- Old name : TCO-7116H1A



Product Number (please contact us)
X1G0023x1xxxx00



Actual size



NEW

Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		SG-770SDD	SG-770SCD	
Output frequency range	f _o	50.000 MHz to 230.000 MHz		Please contact us for inquiries regarding the available frequencies.
Supply voltage	V _{cc}	2.5 V ±0.125 V	3.3 V ±0.165 V	
Storage temperature range	T _{stg}	-55 °C to +125 °C		Store as bare product after unpacking
Operating temperature range	T _{use}	As per below table		
Frequency tolerance	f _{tol}	±50 × 10 ⁻⁶ Max.		
Current consumption	I _{cc}	90 mA Max.		No load condition
Symmetry	SYM	45 % to 55 %		at outputs crossing point
High output voltage	V _{OH}	V _{cc} -1.1 V Min.		
Low output voltage	V _{OL}	V _{cc} -1.5 V Max.		
Output load condition (ECL)	L _{ECL}	LV-PECL		
Output enable / disable input voltage	V _{IH}	70 % V _{cc} Min.		ST terminal
	V _{IL}	20 % V _{cc} Max.		
Rise time / Fall time	t _r / t _f	1 ns Max.		20 % to 80 % (V _{OH} -V _{OL})
Start-up time	t _{str}	10 ms Max. *1		Time at minimum supply voltage to be 0 s
Frequency aging	f _{aging}	±5 × 10 ⁻⁶ / year Max.		+25 °C, V _{cc} =2.5 V or 3.3 V, First year.

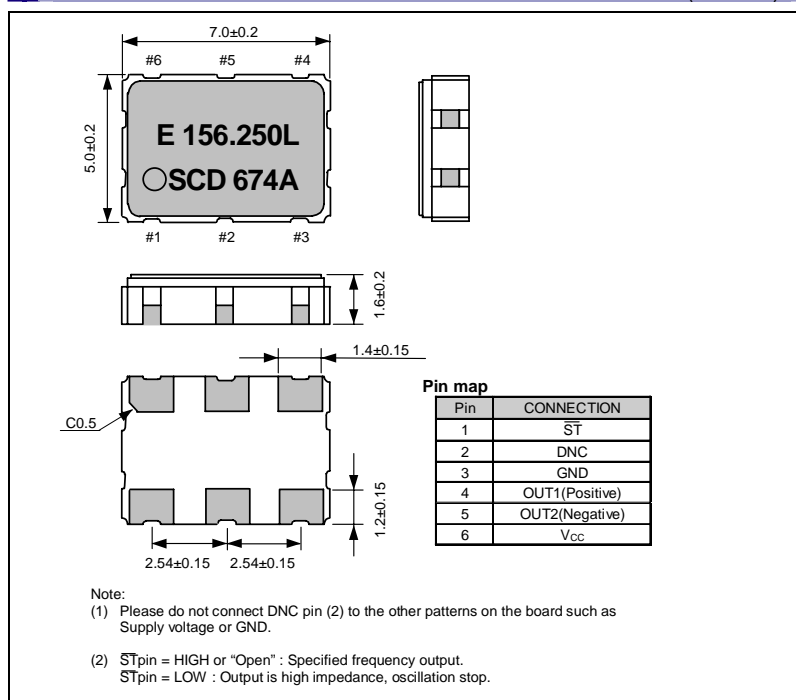
*1 Rise time (0 V to 2.13 V or 3.15 V) of $V_{cc} > 150 \mu s$

Operating temperature range

	Operating temperature range
L	-40 °C to +85 °C
B	-20 °C to +70 °C
P	-10 °C to +70 °C
Q	0 °C to +70 °C

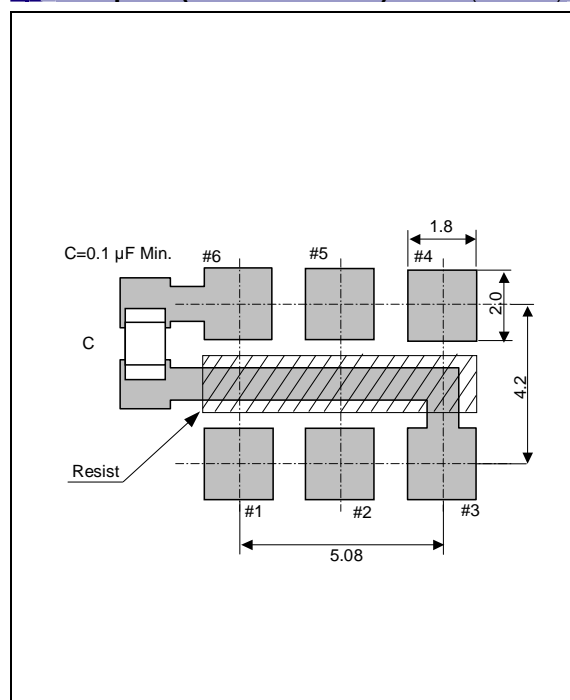
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





CRYSTAL OSCILLATOR SPXO

SG-771 PCD

- Frequency range : 80 MHz to 175 MHz
- Supply voltage : 3.3 V
- Output : LV-PECL
- Thickness : 1.6 mm Typ.
- Features : Fundamental mode oscillator with HFF-XTAL
- Function : Output enable (OE)



Product Number (please contact us)
X1G00282xxxxx00



Actual size



NEW

Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	f _o	80.000 MHz to 175.000 MHz	Please contact us for inquiries regarding the available frequencies.
Supply voltage	V _{cc}	3.3 V ±0.165 V	
Storage temperature range	T _{stg}	-55 °C to +125 °C	Store as bare product after unpacking
Operating temperature range	T _{use}	-10 °C to +70 °C	
Frequency tolerance	f _{tol}	±20 × 10 ⁻⁶ Max.	
Current consumption	I _{cc}	70 mA Max.	No load condition
Symmetry	SYM	40 % to 60 %	V _{cc} -1.3 V
High output voltage	V _{OH}	V _{cc} -1.1 V Min.	
Low output voltage	V _{OL}	V _{cc} -1.5 V Max.	
Output load condition (ECL)	L _{ECL}	LV-PECL	
Output enable / disable input voltage	V _{IH}	70 % V _{cc} Min.	V _{IH} or OPEN : Enable
	V _{IL}	30 % V _{cc} Max.	V _{IL} or GND : Disable
Rise time / Fall time	t _r / t _f	1 ns Max.	20 % to 80 % (V _{OH} -V _{OL})
Start-up time	T _{str}	10 ms Max. *1	Time at minimum supply voltage to be 0 s
Frequency aging	f _{aging}	This is included frequency tolerance	+25 °C, V _{cc} =3.3 V, First year.

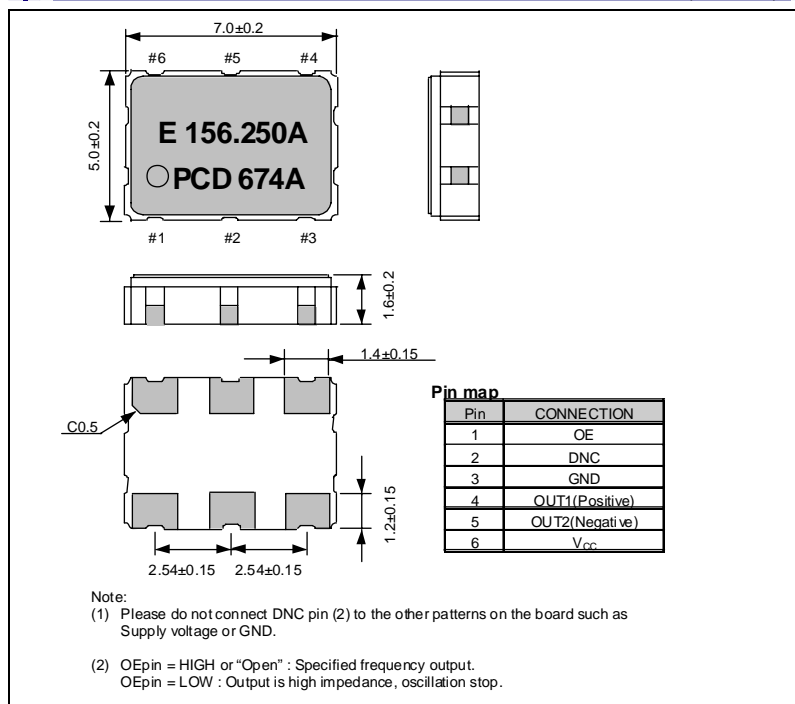
*1 Rise time (or 3.15 V) of V_{cc} > 150 μs.

Operating temperature range

	Frequency tolerance	Operating temperature range	Aging
A	±30 × 10 ⁻⁶ Max.	-40 °C to +85 °C	10 years
B	±35 × 10 ⁻⁶ Max.	-40 °C to +85 °C	20 years
C	±20 × 10 ⁻⁶ Max.	-10 °C to +70 °C	10 years
D	±25 × 10 ⁻⁶ Max.	-10 °C to +70 °C	20 years

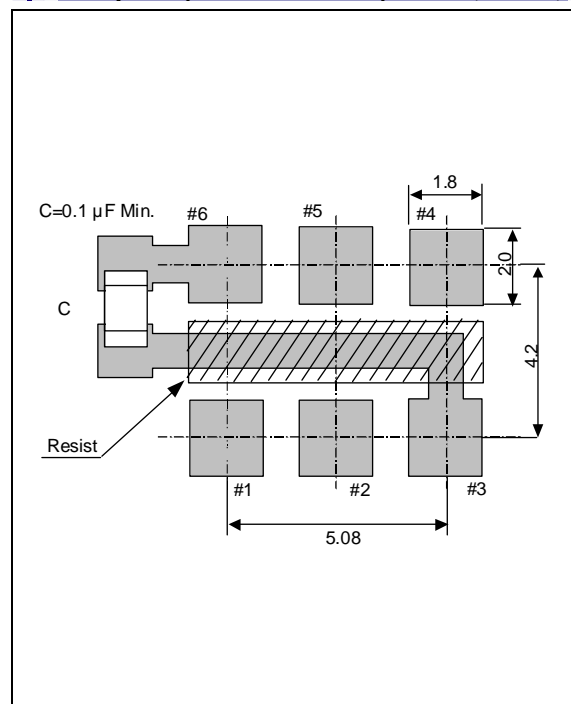
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)



CRYSTAL OSCILLATOR
PROGRAMMABLE

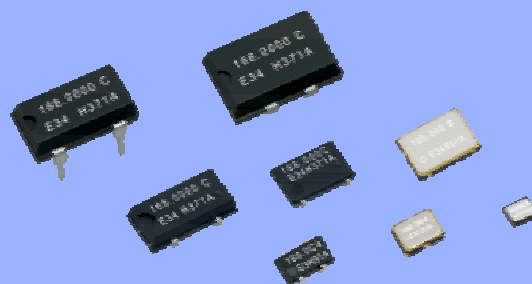
SG - 8003 series

- Frequency range : 1 MHz to 166 MHz
- Supply voltage : 1.8 V Typ. or 2.5 V Typ. or 3.3 V Typ.
- Function : Output enable(OE) or Standby(\overline{ST})

- Short mass production lead time by PLL technology.
 - SG-Writer available to purchase.
- Please contact Epson Toyocom or local sales representative.



Product Number (please contact us)



NEW

Specifications (characteristics)

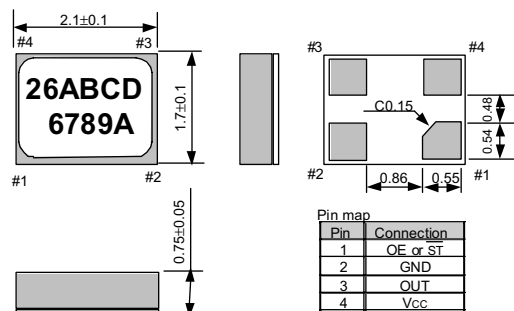
Item		Symbol	Specifications			Remarks	
			PE / SE	PD / SD	PC / SC		
Output frequency range		f ₀	1 MHz to 166 MHz				
Supply voltage		V _{CC}	1.8 V Typ. 1.6 V to 2.2 V	2.5 V Typ. 2.2 V to 2.7 V	3.3 V Typ. 2.7 V to 3.6 V		
Temperature range	Storage temperature	T _{stg}	-40 °C to +85 °C			Store as bare product after unpacking	
	Operating temperature	T _{use}	-20 °C to +70 °C / -40 °C to +85 °C				
Frequency tolerance		f _{tol}	B: ±50 × 10 ⁻⁶ , C: ±100 × 10 ⁻⁶			-20 °C to +70 °C	
			L:±50 × 10 ⁻⁶ , M: ±100 × 10 ⁻⁶			-40 °C to +85 °C	
Current consumption		I _{CC}	10 mA Max.	15 mA Max.		No load condition, f ₀ =166 MHz	
Output disable current		I _{dis}	8 mA Max.			OE=GND (PE,PD,PC)	
Stand-by current		I _{std}	50 µA Max.			ST̄ =GND (SE,SD,SC)	
Symmetry		SYM	45 % to 55 %			50 % V _{CC} level, L _{CMOS} ≤ 15 pF	
High output voltage		V _{OH}	90 % V _{CC} Min.		V _{CC} -0.4 V Min.	I _{OH} =-4mA(PD,SD,PE,SE), -8.0mA(PC,SC)	
Low output voltage		V _{OL}	10 % V _{CC} Max.		0.4 V Max.	I _{OL} = 4 mA(PD,SD,PE,SE), 8.0mA(PC,SC)	
Output load condition (CMOS)		L _{CMOS}	15 pF Max.				
Output enable / disable input voltage		V _{IH}	80 % V _{CC} Min.			OE terminal or ST̄ terminal	
		V _{IL}	20 % V _{CC} Max.				
Rise and Fall time		t _r / t _f	5.0 ns Max.			1 MHz f ₀ < 80 MHz	20 % V _{CC} to 80 % V _{CC} level, L _{CMOS} =15 pF
			2.5 ns Max.			80 MHz f ₀ 166 MHz	
Start-up time		t _{str}	5 ms Max.			t=0 at 90 % V _{CC}	
Frequency aging		f _{aging}	±3 × 10 ⁻⁶ / year Max.			+25 °C, First year, V _{CC} =1.8 V, 2.5 V, 3.3 V	

External dimensions

(Unit:mm)

SG-8003BA

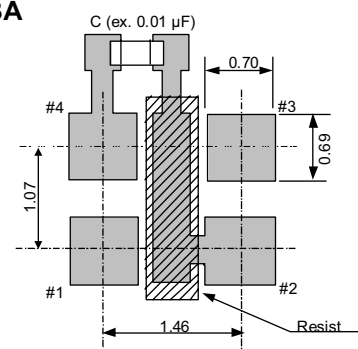
Actual size



Footprint (Recommended)

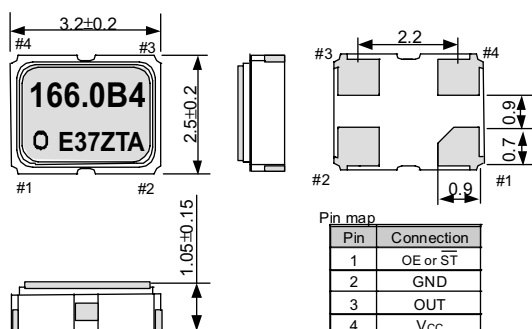
(Unit:mm)

SG-8003BA

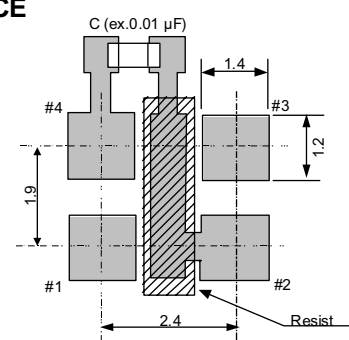


SG-8003CE

Actual size



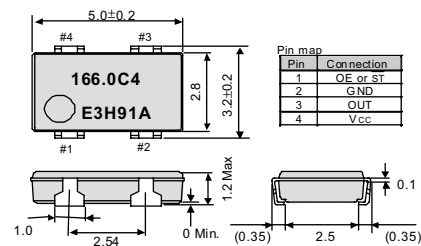
SG-8003CE





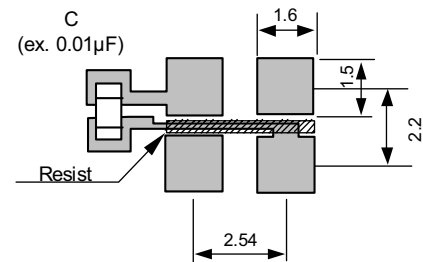
SG-8003LB

Actual size



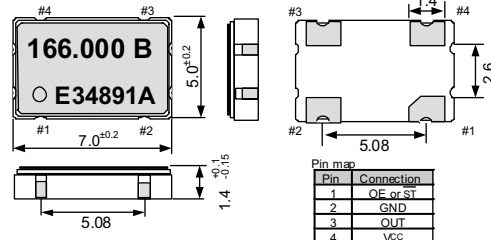
Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

SG-8003LB

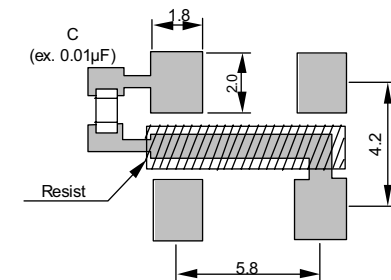


SG-8003CA

Actual size

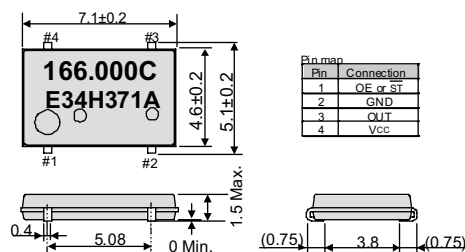


SG-8003CA

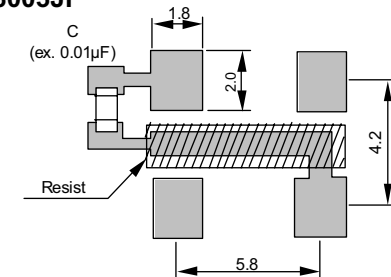


SG-8003JF

Actual size

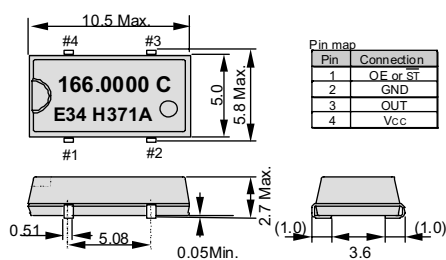


SG-8003JF

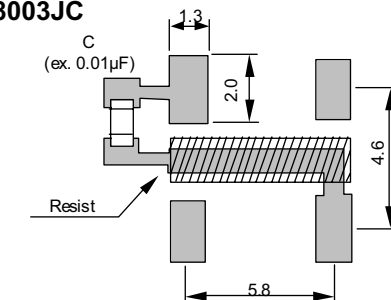


SG-8003JC

Actual size

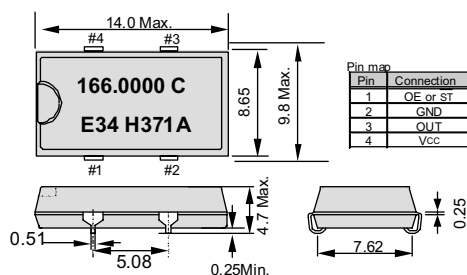


SG-8003JC

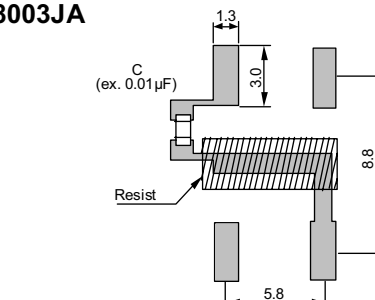


SG-8003JA

Actual size

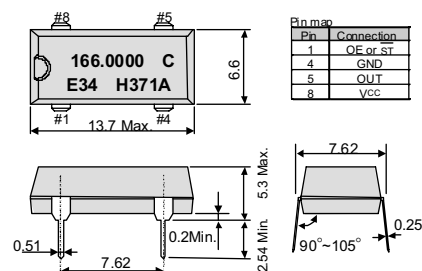


SG-8003JA



SG-8003DC

Actual size



Note.
OE Pin (PE, PD, PC)
OE Pin = "H" or "open" : Specified frequency output.
OE Pin = "L" : Output is low level (weak pull - down), oscillation stops.
ST Pin (SE, SD, SC)
ST Pin = "H" or "open" : Specified frequency output.
ST Pin = "L" : Output is low level (weak pull - down), oscillation stops.



VOLTAGE -CONTROLLED CRYSTAL OSCILLATOR (VCXO)

VG-4231CB

VG-4531CB

- Frequency range : 1 MHz to 80 MHz
- Supply voltage : 3.3 V
- Absolute pull range : $\pm 50 \times 10^{-6}$
- Thickness : 1.2 mm Typ.
- Function : Output enable(OE)



Product Number (please contact us)

VG-4231CB : X1G002861xxx00

VG-4531CB : X1G002881xxx00



Actual size

**NEW**

Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		VG-4231CB	VG-4531CB	
Output frequency range	f _o	1.000 MHz to 60.000 MHz	60.001 MHz to 80.000 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	V _{cc}	3.3 V ± 0.165 V		
Storage temperature range	T _{stg}	-40 °C to +85 °C		Store as bare product after unpacking
Operating temperature range	T _{use}	As per blow table.		
Frequency tolerance	f _{tol}	$\pm 50 \times 10^{-6}$ Max.		Includes frequency aging (20 years)
Current consumption	I _{cc}	10 mA Max.	15 mA Max.	No load condition.
Absolute pull range	APR	$\pm 50 \times 10^{-6}$ Min.		V _c = 1.65 V ± 1.5 V
Input resistance	R _{in}	10 M Ω Min.		DC level
Frequency change polarity	—	Positive slope		V _c = 0.15 to 3.15 V
Symmetry	SYM	45 % to 55 %		50 % V _{cc} level
High output voltage	V _{OH}	V _{cc} -0.4 V Min.		I _{OH} = -0.8mA
Low output voltage	V _{OL}	0.4 V Max.		I _{OL} = 3.2mA
Output load condition (CMOS)	L _{CMOS}	15 pF Max.		
Output enable / disable input voltage	V _{IH}	70 % V _{cc} Min.		V _{IH} or OPEN : Enable
	V _{IL}	30 % V _{cc} Max.		V _{IL} or GND : Disable
Rise time / Fall time	t _r / t _f	6 ns Max.		20 % V _{cc} to 80 % V _{cc} level
Start-up time	t _{str}	10 ms Max.		Time at minimum supply voltage to be 0 s
Frequency aging	f _{aging}	This is included frequency tolerance		+25 °C, V _{cc} = 3.3 V, 20 years

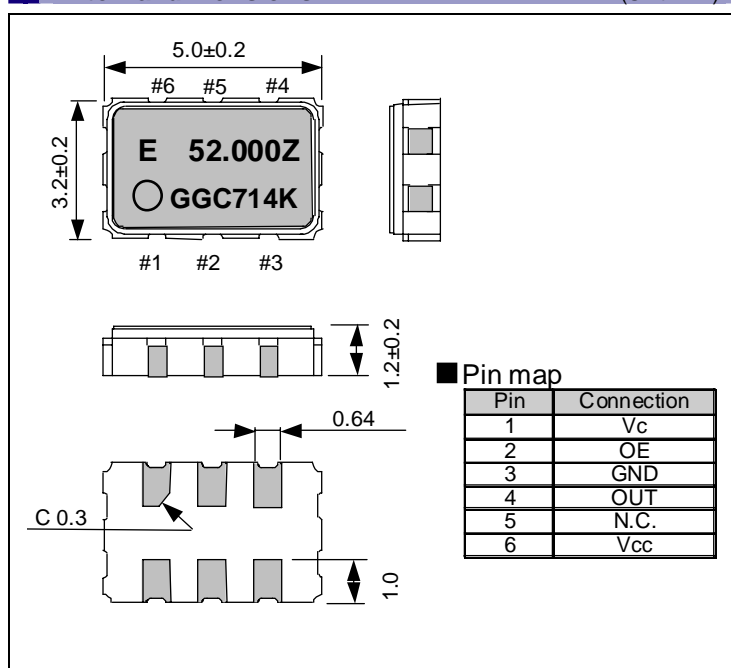
* Please keep V_c pin open or ground while powering up V_{cc}.

Temperature range

	Operating temperature range
GGCT	-40 °C ~ +85 °C
JGCT	-20 °C ~ +70 °C
KGCT	0 °C ~ +70 °C

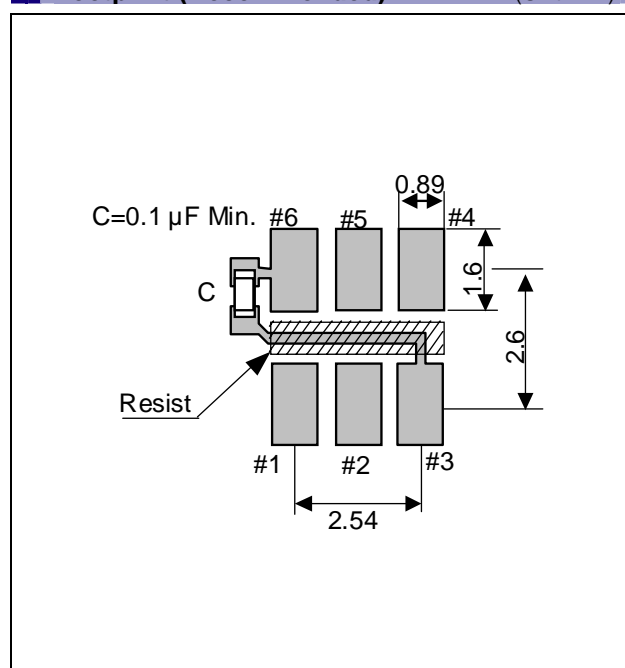
External dimensions

(Unit :mm)



Footprint (Recommended)

(Unit :mm)





VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO)

VG-4501CA

VG-4502CA

- Frequency range : 60 MHz to 80 MHz
- Supply voltage : 3.3 V
- Absolute pull range : VG-4501CA $\pm 50 \times 10^{-6}$
VG-4502CA $\pm 100 \times 10^{-6}$
- Thickness : 1.6 mm Typ.
- Function : Output enable(OE)
- Old name : TCO-7116Z1Z4



Product Number (please contact us)
VG-4501CA : X1G002371xxx00
VG-4502CA : X1G002871xxx00



Actual size

**NEW**

Specifications (characteristics)

Item	Symbol	Specifications		Remarks
		VG-4501CA	VG-4502CA	
Output frequency range	f_o	60.000 MHz to 80.000 MHz		Please contact us for inquiries regarding available frequencies.
Supply voltage	V _{cc}	3.3 V ± 0.165 V		
Storage temperature range	T _{stg}	-55 °C to +125 °C		Store as bare product after unpacking
Operating temperature range	T _{use}	As per blow table.		
Frequency tolerance	f _{tol}	$\pm 50 \times 10^{-6}$ Max.		-40 °C to +85 °C
Current consumption	I _{cc}	35 mA Max.		No load condition.
Absolute pull range*1	APR	GCT : $\pm 50 \times 10^{-6}$ Min.	HCT : $\pm 100 \times 10^{-6}$ Min.	V _c = 1.65 V \pm 1.65V
Input resistance	R _{in}	80 k Ω Min.		DC level
Frequency change polarity	—	Positive slope		V _c = 0 to 3.3 V
Symmetry	SYM	45 % to 55 %		50 % V _{cc} level
High output voltage	V _{OH}	90 % V _{cc} Min.		I _{OH} = -0.8mA
Low output voltage	V _{OL}	10 % V _{cc} Max.		I _{OL} = 3.2mA
Output load condition (CMOS)	L _{CMOS}	15 pF Max.		
Output enable / disable input voltage	V _{IH}	70 % V _{cc} Min.		V _{IH} or OPEN : Enable
	V _{IL}	30 % V _{cc} Max.		V _{IL} or GND : Disable
Rise time / Fall time	t _r / t _f	5 ns Max.		20 % V _{cc} to 80 % V _{cc} level
Start-up time	t _{str}	10 ms Max. *2		Time at minimum supply voltage to be 0 s
Frequency aging	f _{aging}	This is included Absolute pull range		+25 °C, V _{cc} = 3.3 V, 20 years

*1 Absolute pull range = Frequency control range- (Frequency tolerance + 20 years Aging + Free fall + Vibration)

*2 Rise time (or 3.15 V) of V_{cc} > 150 μ s

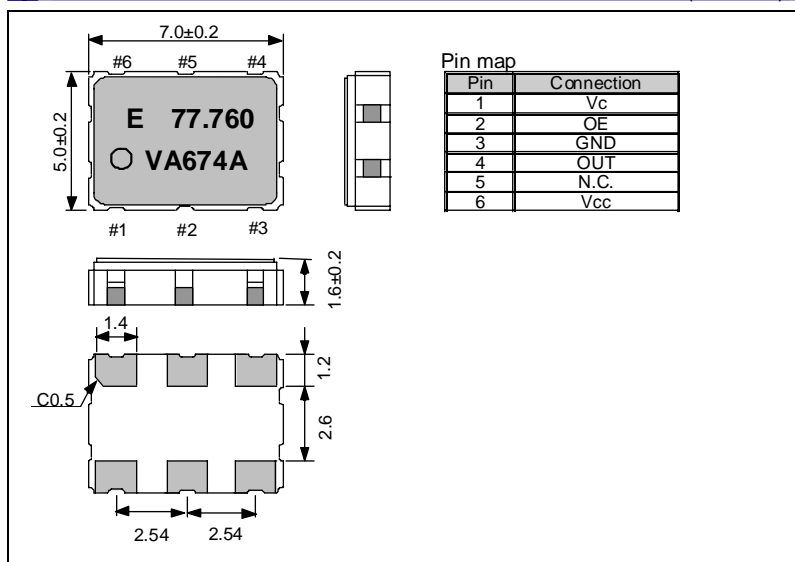
* Please keep V_c pin open or ground while powering up V_{cc}.

Operating temperature range

Operating temperature range		Absolute pull range	
		VG-4501CA $\pm 50 \times 10^{-6}$ Min.	VG-4502CA $\pm 100 \times 10^{-6}$ Min.
G	-40 °C to +85 °C	GGCT	GHCT
J	-20 °C to +70 °C	JGCT	JHCT
K	0 °C to +70 °C	KGCT	KHCT

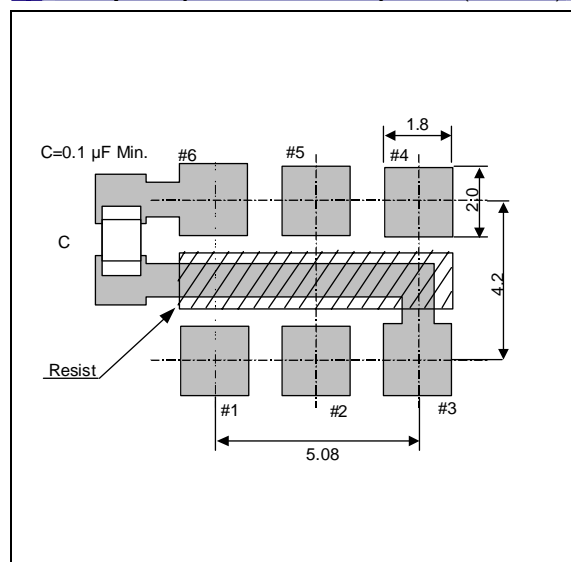
External dimensions

(Unit :mm)



Footprint (Recommended)

(Unit :mm)



VOLTAGE-CONTROLLED CRYSTAL OSCILLATOR (VCXO)

VG-4511CA

- Frequency range : 80 MHz to 170 MHz LV-PECL
- Supply voltage : 3.3 V
- Absolute pull range : $\pm 50 \times 10^{-6}$
- Thickness : 1.6 mm Typ.
- Function : Output enable(OE)



Product Number (please contact us)
X1G002781xxxx00



Actual size

**NEW**

Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Output frequency range	f _o	80.000 MHz to 170.000 MHz	Please contact us for inquiries regarding available frequencies.
Supply voltage	V _{CC}	3.3 V ±0.165 V	
Storage temperature range	T _{stg}	-55 °C to +125 °C	Store as bare product after unpacking
Operating temperature range	T _{use}	As per blow table.	
Frequency tolerance	f _{tol}	±50 × 10 ⁻⁶ Max.	Includes frequency aging (20 years)
Current consumption	I _{CC}	70 mA Max.	No load condition.
Absolute pull range	APR	GCT:±50 × 10 ⁻⁶ Min.	V _C = 1.65 V ± 1.5V
Input resistance	R _{in}	100 kΩ Min.	DC level
Frequency change polarity	—	Positive slope	V _C = 0 to 3.3 V
Symmetry	SYM	40 % to 60 %	—
High output voltage	V _{OH}	V _{CC} -1.1V Min.	—
Low output voltage	V _{OL}	V _{CC} -1.5V Max.	—
Output load condition (ECL)	L _{ECL}	LV-PECL	
Output enable / disable input voltage	V _{IH}	70 % V _{CC} Min.	V _{IH} or OPEN : Enable
	V _{IL}	30 % V _{CC} Max.	V _{IL} or GND : Disable
Rise time / Fall time	t _r / t _f	1.5 ns Max.	20 % V _{CC} to 80 % V _{CC} level
Start-up time	t _{str}	10 ms Max.	Time at minimum supply voltage to be 0 s
Frequency aging	f _{aging}	This is included frequency tolerance	+25 °C, V _{CC} =3.3 V, 20 years

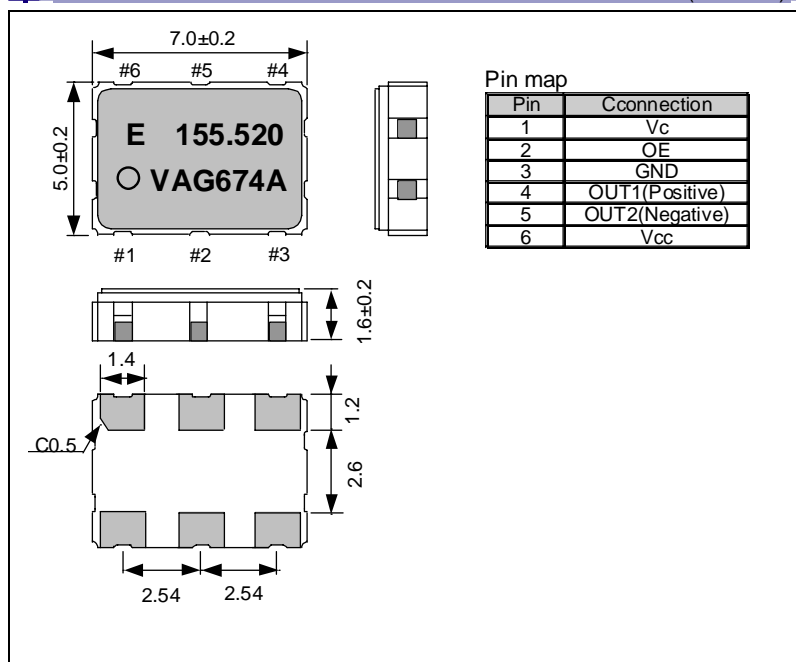
* Please keep Vc pin open or ground while powering up Vcc.

Operating temperature range

	Operating temperature range
GGCT	-40 °C ~ +85 °C
JGCT	-20 °C ~ +70 °C
KGCT	0 °C ~ +70 °C

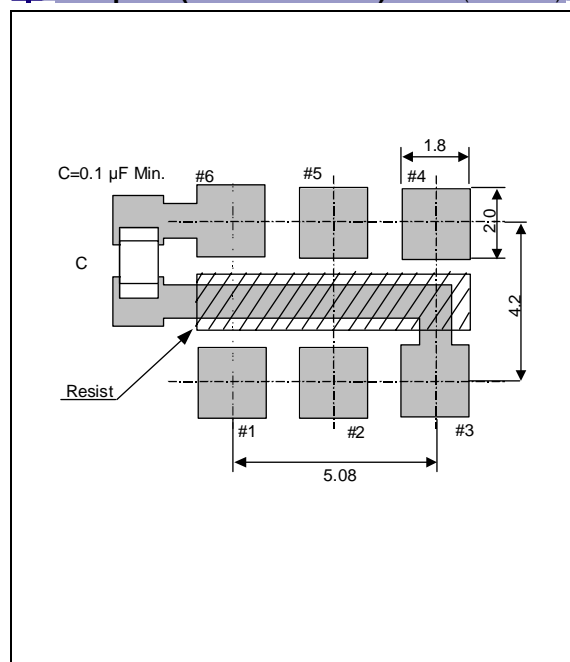
External dimensions

(Unit :mm)



Footprint (Recommended)

(Unit :mm)





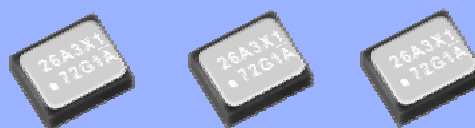
TCXO ULTRA MINIATURE SIZE LOW PROFILE

TG-5021BA

- Frequency range : 13 MHz to 52 MHz
- Supply voltage : 2.8 V Typ.
- External dimensions : 2.1 × 1.7 × 0.75 t mm Typ.
- Applications : Cellular phone(GSM,CDMA,WCDMA)
- Features : World's smallest size,Low Noise



Product Number (Please contact us)
X1G003571xxxx00



Actual size

NEW

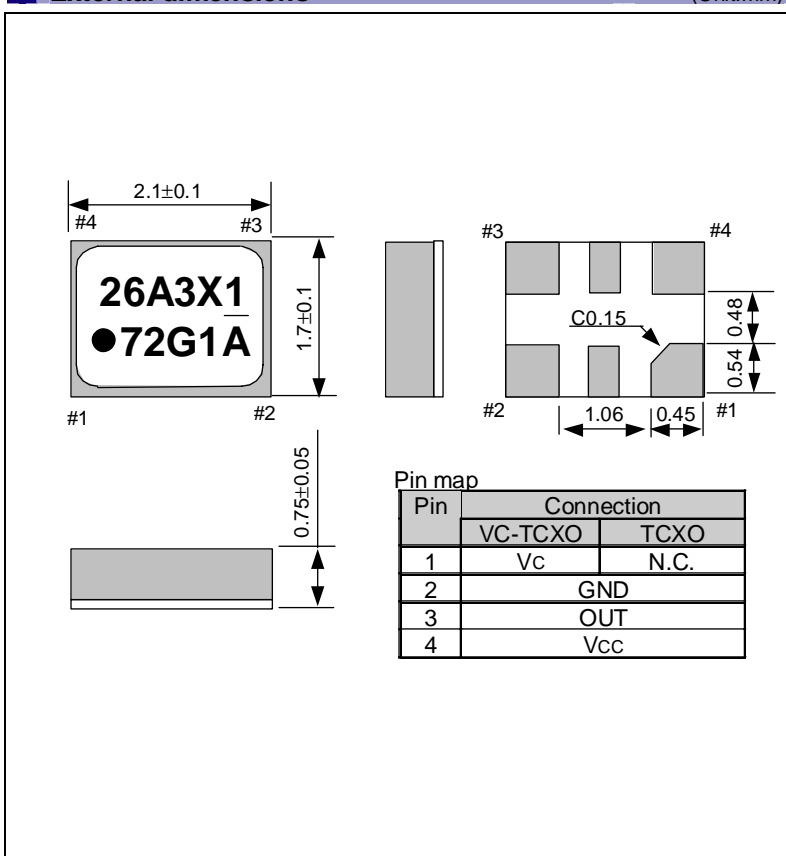
Specifications (characteristics)

Item		Symbol	Specifications		Remarks
			VC-TCXO	TCXO	
Output frequency range		f ₀	13.000 MHz to 52.000 MHz		Standard frequency
			13 MHz, 19.2 MHz, 26 MHz, 27.456 MHz,38.4 MHz		
Supply voltage		V _{cc}	2.8 V±0.14 V		2.3 V to 3.6 V
Temperature range	Storage temperature	T _{stg}	-40 °C to +85 °C		Store as bare product after unpacking
	Operating temperature	T _{use}	-30 °C to +85 °C		
Frequency tolerance		f _{tol}	±2.0 ×10 ⁻⁶ Max.		After reflow, V _C =1.4 V, +25 °C
Frequency / temperature characteristics		fo-Tc	±2.0 × 10 ⁻⁶ Max.		-30 °C to +85 °C
Frequency / load coefficient		fo-Load	±0.2 × 10 ⁻⁶ Max.		10 kΩ // 10 pF ±10 %
Frequency / voltage coefficient		fo-Vcc	±0.2 ×10 ⁻⁶ Max.		2.8 V ± 0.14 V
Frequency aging		f _{age}	±1.0 ×10 ⁻⁶ Max.		+25 °C, First year
Current consumption		I _{cc}	2.0 mA Max.		13 MHz to 40 MHz
			2.5 mA Max.		40 MHz to 52 MHz
Input resistance		R _{in}	500 kΩ Min.	—	V _C -GND(DC)
Frequency control range		f _{cont}	±5.0 × 10 ⁻⁶ to ±12.0 ×10 ⁻⁶	—	V _C =1.4V ±1.0 V
Frequency change polarity		—	Positive polarity	—	
Symmetry		SYM	40 % to 60 %		GND level (DC cut)
Output voltage		V _{PP}	0.8 V Min.		Peak to peak
Load resistance		Load_R	10 kΩ		DC cut capacitor = 0.01 μF
Load capacitance		Load_C	10 pF		

Note: Please contact us for inquiries about specifications other than the above.

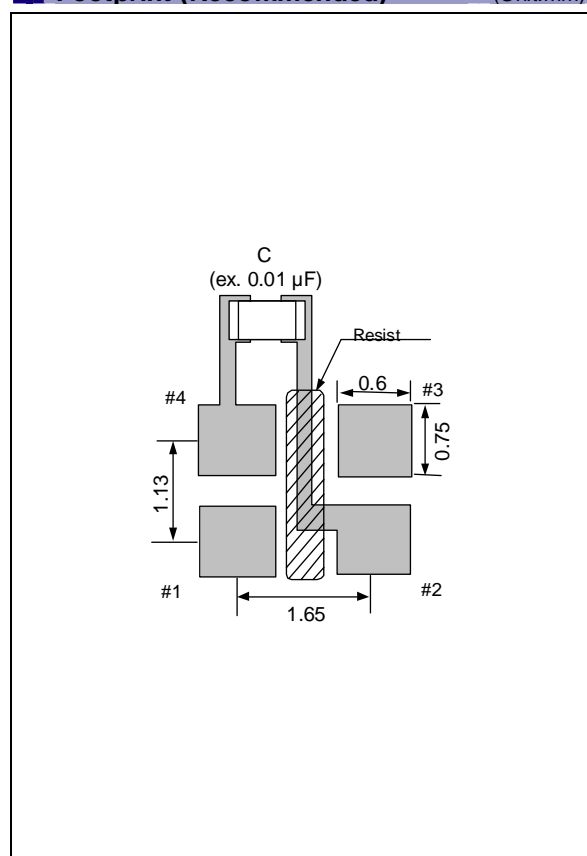
External dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





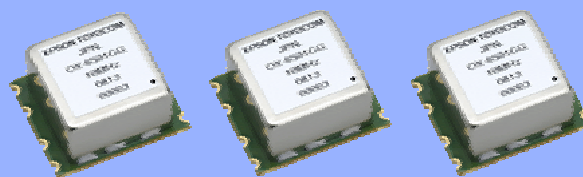
Oven Controlled Crystal Oscillator (OCXO)

OX-6501GG series

- Features : Low profile full SMD package
- : Very fast warm-up and accurate stability
- : IPC/JEDEC J-STD-020C reflowable
- : SC-Cut Crystal unit



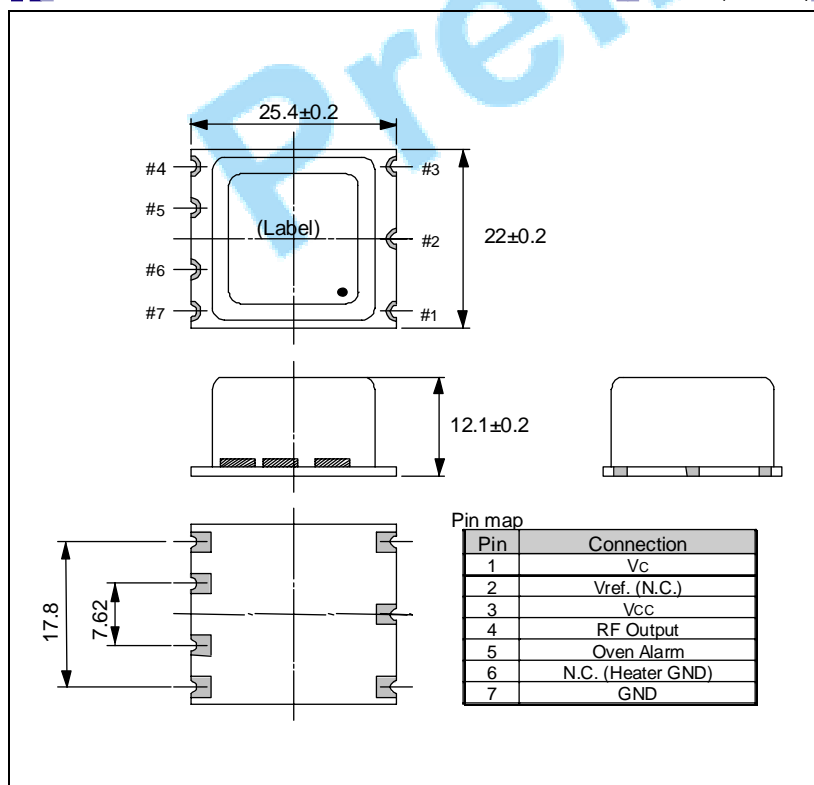
Product number (please contact us)

**PRELIMINARY****Specifications (characteristics)**

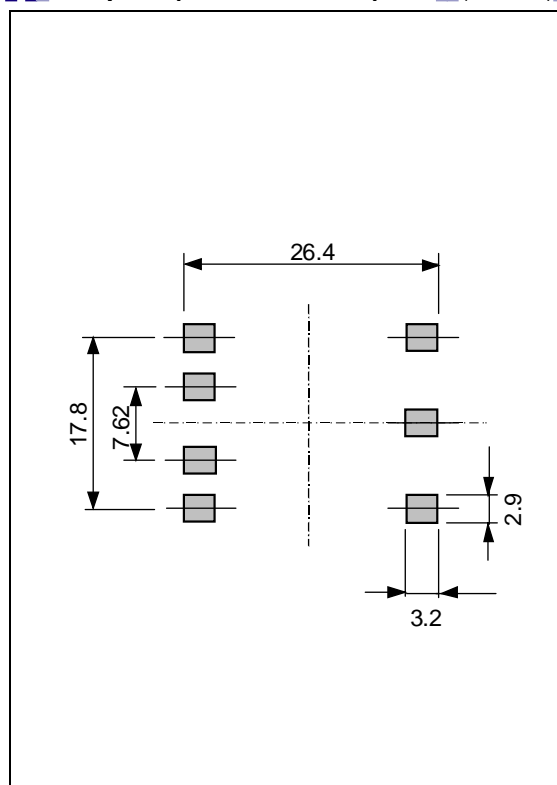
Item	Symbol	Specifications		
Output frequency range	f _o	10.000 MHz to 40.000 MHz		
		10 MHz, 30.72 MHz		Standard frequency
Supply voltage	V _{cc}	3.3 V ±0.165 V	5.0 V ±0.25 V	
Storage temperature range	T _{stg}	-40 °C to +85 °C		During transportation only. Long term storage : Room temperature.
Operating temperature range	T _{use}	-10 °C to +70 °C		
Frequency/temperature characteristics	f _o -T _c	±2.5 × 10 ⁻⁸ Max.		-10 °C to +70 °C
Frequency/voltage coefficient	f _o -V _{cc}	±5 × 10 ⁻⁹ Max. OP.: ±2 × 10 ⁻⁹ Max.		V _{cc} =3.3 V ±0.165 V V _{cc} =5.0 V ±0.25 V
Frequency aging	f _{age}	±1 × 10 ⁻⁸ / dayMax. OP.: ±1 × 10 ⁻⁹ / dayMax. ±1 × 10 ⁻⁷ / year Max. OP.: ±3 × 10 ⁻⁸ / year Max.		
Warm-up	—	±5 × 10 ⁻⁸ / 5 min Max.		+25 °C
Current consumption	Warm-up	I _{cc}	750 mA Max.	600 mA Max.
	Steady state		300 mA Max.	200 mA Max.
Frequency control range	f _{cont}	±1 × 10 ⁻⁶ Min.		at +25 °C
Symmetry	SYM	45 % to 55 %		V _c =1.4 V±1.4 V, V _c =2.0 V±2.0 V (V _{OH} -V _{OL})/2
High output voltage	V _{OH}	2.4 V Min.	2.8 V Min.	CMOS
Low output voltage	V _{OL}	0.4 V Max.	0.4 V Max.	
Load resistance	Load_R	10 kΩ		
Load capacitance	Load_C	15 pF		
Weight	—	10 g Max.		

External dimensions

(Unit:mm)

**Footprint (Recommended)**

(Unit:mm)



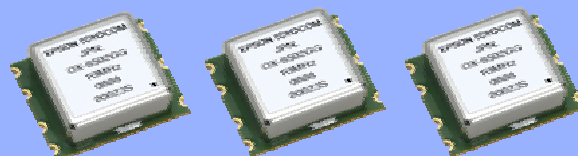


Product number (please contact us)

Oven Controlled Crystal Oscillator (OCXO)

OX - 6502GG series

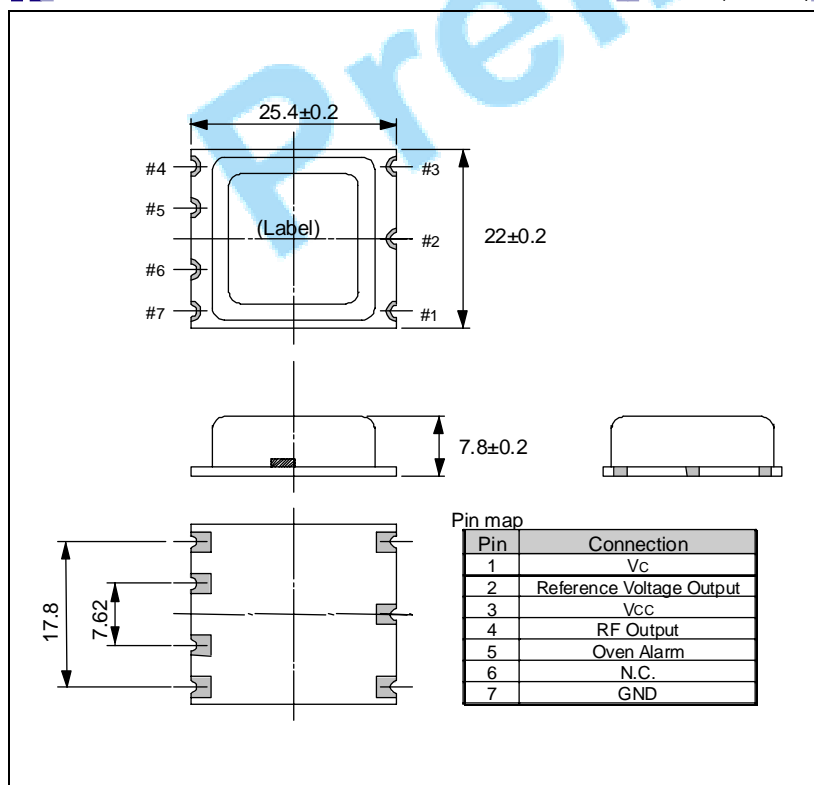
- Features : Low profile full SMD package
- : Very fast warm-up and accurate stability
- : IPC/JEDEC J-STD-020C reflowable
- : SC-Cut Crystal unit

**PRELIMINARY****Specifications (characteristics)**

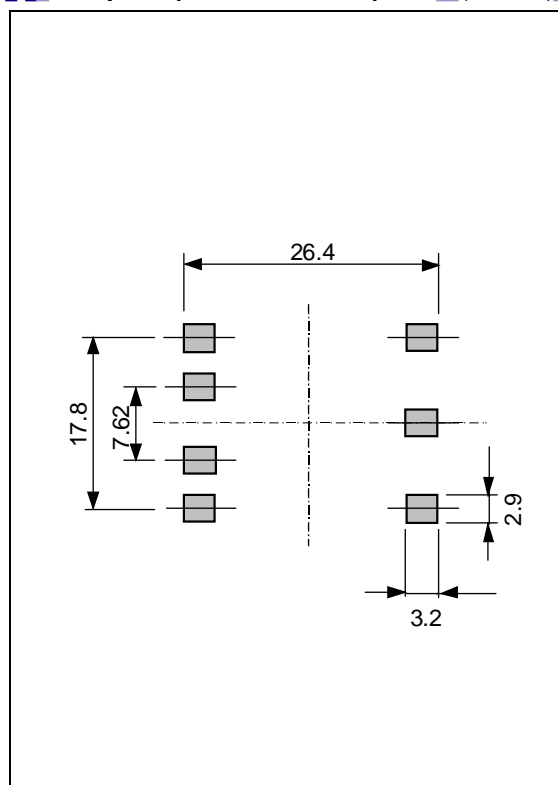
Item	Symbol	Specifications		
Output frequency range	f _o	10.000 MHz to 40.000 MHz		
		10 MHz		Standard frequency
Supply voltage	V _{cc}	3.3 V ±0.165 V	5.0 V ±0.25 V	
Storage temperature range	T _{stg}	-40 °C to +85 °C		During transportation only. Long term storage : Room temperature.
Operating temperature range	T _{use}	-10 °C to +70 °C		
Frequency/temperature characteristics	f _o -T _c	±2.5 × 10 ⁻⁸ Max.		-10 °C to +70 °C
Frequency/voltage coefficient	f _o -V _{cc}	±5 × 10 ⁻⁹ Max.		V _{cc} =3.3 V ±0.165 V V _{cc} =5.0 V ±0.25 V
Frequency aging	f _{age}	±1 × 10 ⁻⁸ / dayMax. ±1 × 10 ⁻⁷ / year Max.		
Warm-up	—	±5 × 10 ⁻⁸ / 5 min Max.		+25 °C
Current consumption	Warm-up	I _{cc}	750 mA Max.	600 mA Max.
	Steady state		300 mA Max.	200 mA Max.
Frequency control range	f _{cont}	±1 × 10 ⁻⁶ Min.		V _c =1.4 V±1.4 V, V _c =2.0 V±2.0 V
Symmetry	SYM	45 % to 55 %		(V _{OH} - V _{OL})/2
High output voltage	V _{OH}	2.4 V Min.	2.8 V Min.	CMOS
Low output voltage	V _{OL}	0.4 V Max.	0.4 V Max.	
Load resistance	Load_R	10 kΩ		
Load capacitance	Load_C	15 pF		
Weight	—	10 g Max.		

External dimensions

(Unit:mm)

**Footprint (Recommended)**

(Unit:mm)





Oven Controlled Crystal Oscillator (OCXO)

OX - 6601DL series

- Features : Small size and low power
- : Fast warm-up and high stability
- : SC-Cut Crystal unit



Product number (please contact us)

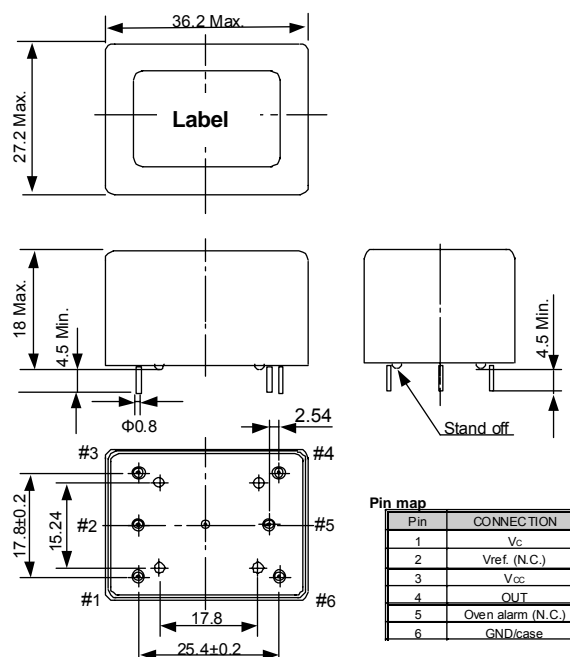
**NEW**

Specifications (characteristics)

Item	Symbol	Specifications		Remarks
Output frequency range	fo	10 MHz to 40 MHz		
		10 MHz		Standard frequency
Supply voltage	Vcc	3.3 V ± 0.165 V	5.0 V ± 0.25 V	
Storage temperature range	T_stg	-40 °C to +85 °C		During transport only.
Operating temperature range	T_use	-10 °C to +70 °C		Long term storage: Room Temperature.
Frequency/temperature characteristics	fo-Tc	$\pm 8 \times 10^{-9}$ Max.		-10 °C to +70 °C
Frequency/voltage coefficient	fo-Vcc	$\pm 2 \times 10^{-9}$ Max.		Vcc=3.3 V ± 0.165 V Vcc=5 V ± 0.25 V
Frequency aging	f_age	$\pm 1 \times 10^{-9}$ / day Max. $\pm 3 \times 10^{-8}$ / year Max.		
Warm-up	—	$\pm 5 \times 10^{-8}$ / 5 min Max.		+25 °C
Current consumption	Warm-up	750 mA Max.		
	Steady state	300 mA Max.		
Frequency control range	f_cont	600 mA Max.		
		200 mA Max.		at +25 °C
Symmetry	SYM	$\pm 1 \times 10^{-6}$ Min.		Vc = 1.4 V ± 1.4 V (Vcc=3.3 V) Vc = 2.0 V ± 2.0 V (Vcc=5.0 V) (VOH - VOL)/2
High output voltage	VOH	2.4 V Min.	2.8 V Min.	
Low output voltage	VOL	0.4 V Max.	0.4 V Max.	CMOS
Load resistance	Load_R	10 k Ω		
Load capacitance	Load_C	15 pF		
Weight	—	30 g Max.		

External dimensions

(Unit:mm)





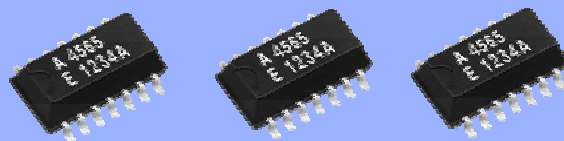
For Automotive SERIAL INTERFACE REAL TIME CLOCK MODULE

RA - 4565 SA

- Built in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : 4-wire serial interface
- Wide operating voltage range : 1.6 V to 5.5 V
- Wide Timekeeper voltage range : 1.5 V to 5.5 V
Ta = -40 °C to +125 °C
- Extended operating temperature range: -40 °C to +125 °C
- 32.768 kHz frequency output function : Open drain output
with Control Pin
- 32.768 kHz Clock/calendar function, auto leap year correction function, alarm interrupt function, etc.



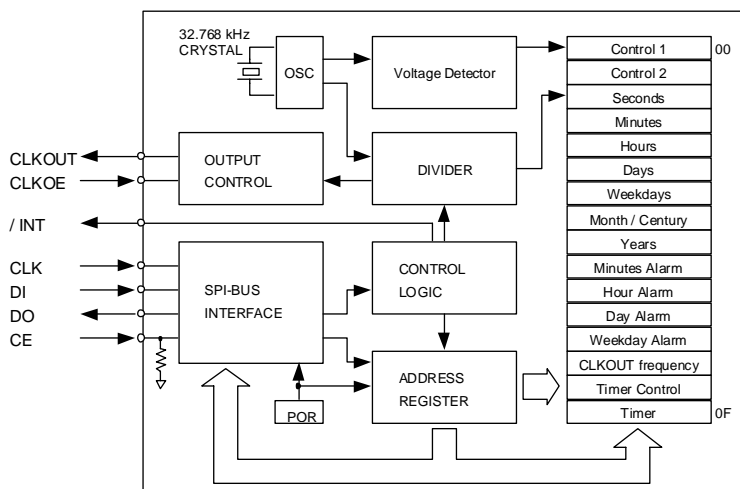
Product Number (Please contact us)
RA-4565SA : Q41A46550xxxx00



Actual size

**NEW**

Block diagram



Overview

- **Wide operating temperature range**
 - -40 °C to +125 °C
- **Clocking-status detection function**
 - It can judge the validity of data after backup operation return by a status of VL-bit.
- **32.768 kHz frequency output function**
 - CLKOUT pin output (Open Drain output)
 - Output frequency can be selected as 32.768 kHz, 1024 Hz, 32 Hz, or 1 Hz.
- **The various interrupt function**
 - Timer function can be set up between 1/4096 second and 255 minutes.
 - Alarm function can be set to day of week, day, hour, or minute.

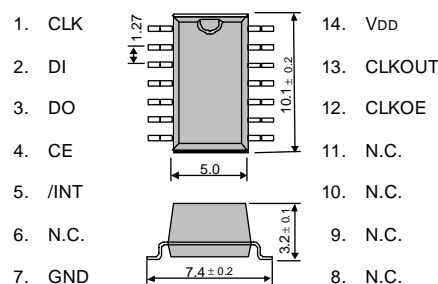
Pin Function

Terminal	Directions	Functions
CE	Input	Chip enabled input.
CLK	Input	Serial clock input.
DI	Input	Data input.
DO	Output	Data output.
CLKOUT	Output	The CLKOUT pin is a clock output (open drain output) pin with control output. (Output frequency can be selected as 32.768 kHz, 1024 Hz, 32 Hz, or 1 Hz.)
CLKOE	Input	The CLKOE pin is an input pin used to control the output mode of the CLKOUT output pin. During the initial power-on (when power is applied from 0 V), if the CLKOE input pin is at high level (= H), the power-on reset function selects 32.768 kHz as the frequency.
/INT	Output	Interrupts output by Alarm and Timer events. (Open drain output)
VDD	—	VDD
GND	—	GND

Terminal connection / External dimensions

(Unit:mm)

RA-4565 SA



SOP - 14 pin

Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Conditions	Min.	Tvp.	Max.	unit
Operating voltage	VDD	—	1.6	3.0	5.5	V
Timekeeper voltage	VCLK	—	1.5	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+125	°C

Frequency characteristics

Item	Symbol	Conditions	Rating	unit
Frequency stability	$\Delta f / f$	Ta = +25 °C VDD = 3.0 V	5 ± 23 *1	× 10 ⁻⁶
Oscillation start up time	tSTA	Ta = +25 °C VDD = 1.6 V Ta = -40 °C to +125 °C VDD = 3.0 V	1.5 Max. 3.0 Max.	s

*1) Equivalent to 1 minutes of monthly deviation.

Current consumption under backup mode.

Item	Symbol	Conditions	Min.	Tvp.	Max.	unit
Standby current.	IBK	fSCL = 0 Hz CLKOE = "L" VDD = 5 V	+125 °C	1.0	2.0	μA
			-40 to +85 °C	0.6	1.2	
		fSCL = 0 Hz CLKOE = "L" VDD = 3 V	+125 °C	0.8	1.6	μA
			-40 to +85 °C	0.5	1.0	



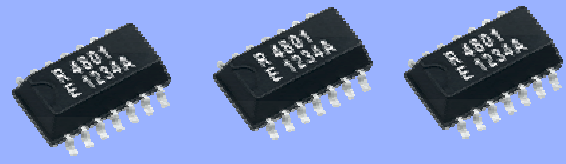
Built-in 32.768 kHz-DTCXO, High Stability SERIAL-INTERFACE REAL TIME CLOCK MODULE

RX - 4801 SA

- Built in frequency adjusted 32.768 kHz crystal unit and DTCXO.
- Interface Type : 4-wire serial interface
- Interface voltage range : 1.8 V to 5.5 V
- Temp.compensated voltage range: 2.2 V to 5.5 V
- Wide Timekeeper voltage range : 1.6 V to 5.5 V
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer.



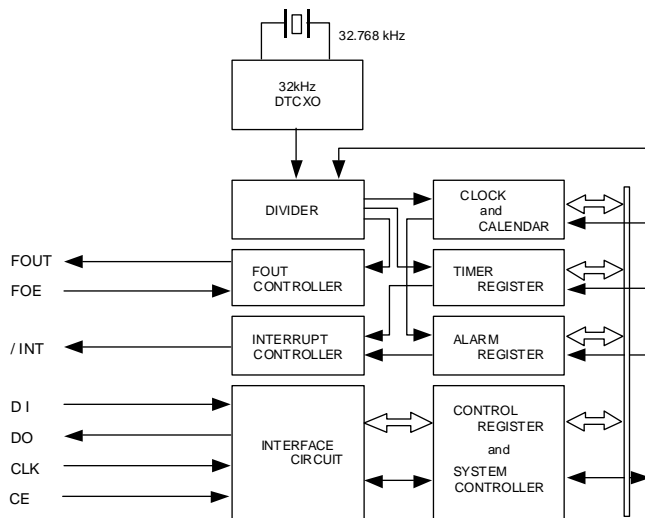
Product Number (Please contact us)
RX-4801SA : X1B000021xxxx00



Actual size

**NEW**

Block diagram



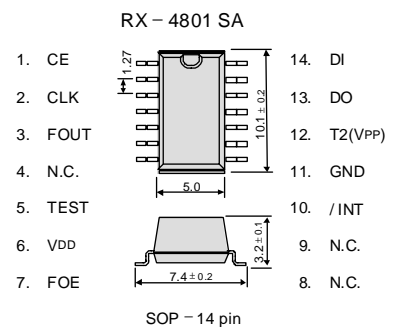
Overview

- High Stability
 - UA
 - $\pm 1.9 \times 10^{-6}$ / 0 °C to +40 °C
(Equivalent to 5 seconds of month deviation)
 - $\pm 3.4 \times 10^{-6}$ / -40 °C to +85 °C
(Equivalent to 9 seconds of month deviation)
 - UB
 - $\pm 3.8 \times 10^{-6}$ / 0 °C to +50 °C
(Equivalent to 10 seconds of month deviation)
 - $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C
(Equivalent to 13 seconds of month deviation)
- 32.768 kHz frequency output function
 - FOUT pin output (C-MOS output), CL=30 pF
 - Output selectable
< 32.768 kHz, 1024 Hz, 1 Hz >
- The various interrupt
 - Timer Function can be set up between 1/4096 second and 255 minutes.
 - Alarm Function can be set to day of week, day, hour, or minute.

Pin Function

Signal Name	Pin No.	I / O	Function
CE	1	input	The chip enable input pin.
CLK	2	input	The shift clock input pin for serial data transfer.
FOUT	3	Output	The pin outputs the reference clock signal. (CMOS output)
TEST	5	input	* Use by the manufacture for testing. (Do not connect externally.)
VDD	6	-	Connected to a positive power supply
FOE	7	input	The input pin for the FOUT output control.
/INT	10	Output	The open drain output for interrupt.
GND	11	-	Connected to a ground
T2(VPP)	12	-	* Use by the manufacture for testing. (Do not connect externally.)
DO	13	Output	The data output pin for serial data transfer.
D I	14	input	The data input pin for serial data transfer.

Terminal connection / External dimensions (Unit:mm)



SOP - 14 pin
Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

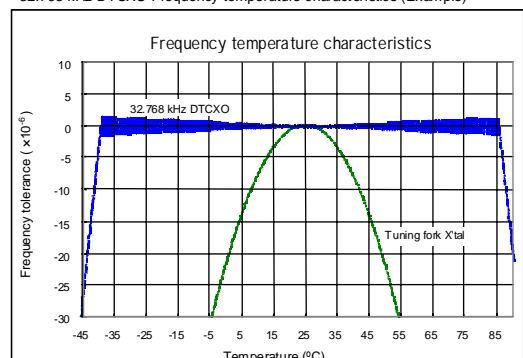
Electrical Characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Interface voltage	VDD	Interface voltage	1.8	3.0	5.5	V	
Temp. compensated voltage	VTEM	Temp. compensated voltage	2.2	3.0	5.5	V	
Clock voltage	VCLK	-	1.6	3.0	5.5	V	
Operating temperature	TOPR	-	-40	+25	+85	°C	
Stability	$\Delta f / f$	UA	Ta = 0 °C to +40 °C	$\pm 1.9^{*1}$		$\times 10^{-6}$	
			Ta = -40 °C to +85 °C	$\pm 3.4^{*2}$			
		UB	Ta = 0 °C to +50 °C	$\pm 3.8^{*3}$			
			Ta = -40 °C to +85 °C	$\pm 5.0^{*4}$			
Current consumption (1)	IBK1	Backup Mode FOE = GND, /INT = VDD FOUT output : OFF	VDD = 5V	-	1.2	3.4	μA
Current consumption (2)	IBK2		VDD = 3V	-	0.8	2.8	

*1) Equivalent to 5 seconds of month deviation. *2) Equivalent to 9 seconds of month deviation.

*3) Equivalent to 10 seconds of month deviation. *4) Equivalent to 13 seconds of month deviation.

32.768 kHz-DTCXO Frequency temperature characteristics (Example)





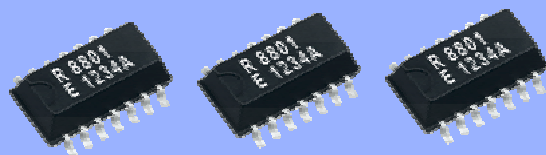
Built-in 32.768 kHz-DTCXO, High Stability I²C-Bus INTERFACE REAL TIME CLOCK MODULE

RX - 8801 SA

- Built in frequency adjusted 32.768 kHz crystal unit and DTCXO.
- Interface Type : I²C-Bus Interface (400 kHz)
- Interface voltage range : 1.8 V to 5.5 V
- Temp.compensated voltage range: 2.2 V to 5.5 V
- Wide Timekeeper voltage range : 1.6 V to 5.5 V
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- The various functions include full calendar, alarm, timer.



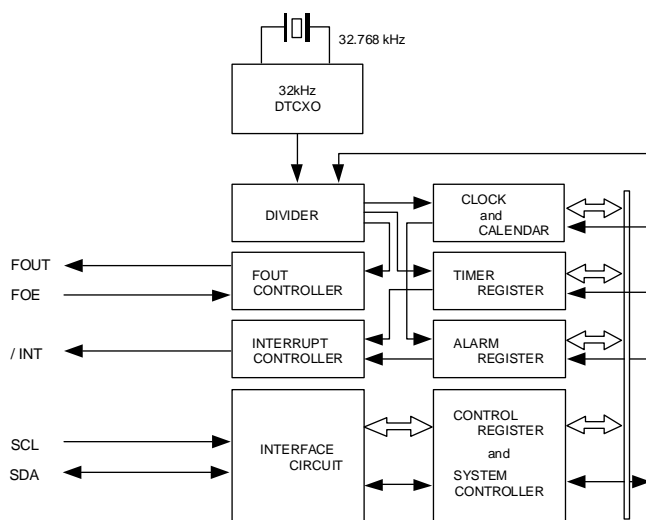
Product Number (Please contact us)
RX-8801SA : X1B000011xxxx00



Actual size

**NEW**

Block diagram



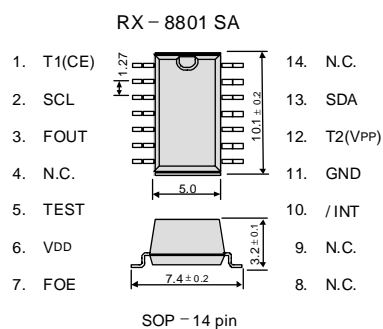
Overview

- High Stability
 - UA
 - $\pm 1.9 \times 10^{-6}$ / 0 °C to +40 °C
(Equivalent to 5 seconds of month deviation)
 - $\pm 3.4 \times 10^{-6}$ / -40 °C to +85 °C
(Equivalent to 9 seconds of month deviation)
 - UB
 - $\pm 3.8 \times 10^{-6}$ / 0 °C to +50 °C
(Equivalent to 10 seconds of month deviation)
 - $\pm 5.0 \times 10^{-6}$ / -40 °C to +85 °C
(Equivalent to 13 seconds of month deviation)
- 32.768 kHz frequency output function
 - FOUT pin output (C-MOS output), CL=30 pF
 - Output selectable
< 32.768 kHz, 1024 Hz, 1 Hz >
- The various interrupt
 - Timer Function can be set up between 1/4096 second and 255 minutes.
 - Alarm Function can be set to day of week, day, hour, or minute.

Pin Function

Signal Name	Pin No.	I / O	Function
T1(CE)	1	input	* Use by the manufacture for testing. (Do not connect externally.)
SCL	2	input	Serial clock input pin
FOUT	3	Output	The pin outputs the reference clock signal. (CMOS output)
TEST	5	input	* Use by the manufacture for testing. (Do not connect externally.)
VDD	6	-	Connected to a positive power supply
FOE	7	input	The input pin for the FOUT output control.
/INT	10	Output	Interrupt output (N-ch open drain)
GND	11	-	Connected to a ground
T2(VPP)	12	-	* Use by the manufacture for testing. (Do not connect externally.)
SDA	13	I / O	Data input and output pin

Terminal connection / External dimensions (Unit:mm)



SOP - 14 pin
Metal may be exposed on the top or bottom of this product.
This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

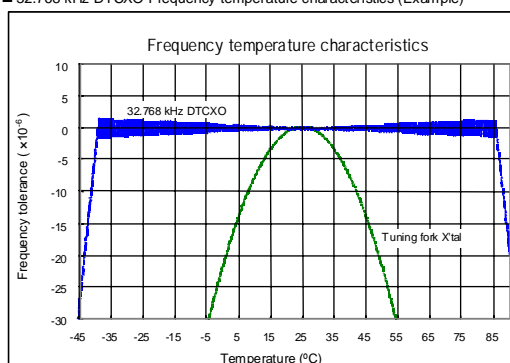
Electrical Characteristics

Electrical Characteristics							
Item	Symbol	Condition	Min.	Typ.	Max.	Unit	
Interface voltage	VDD	Interface voltage	1.8	3.0	5.5	V	
Temp. compensated voltage	VTEM	Temp. compensated voltage	2.2	3.0	5.5	V	
Clock voltage	VCLK	-	1.6	3.0	5.5	V	
Operating temperature	TOPR	-	-40	+25	+85	°C	
Stability	$\Delta f / f$	UA	Ta = 0 °C to +40 °C		$\pm 1.9^{*1}$	$\times 10^{-6}$	
			Ta = -40 °C to +85 °C		$\pm 3.4^{*2}$		
		UB	Ta = 0 °C to +50 °C		$\pm 3.8^{*3}$		
			Ta = -40 °C to +85 °C		$\pm 5.0^{*4}$		
Current consumption (1)	IBK1	Backup Mode FOE = GND, /INT = VDD FOUT output : OFF	VDD = 5V	-	1.2	3.4	μA
Current consumption (2)	IBK2		VDD = 3V	-	0.8	2.8	

*1) Equivalent to 5 seconds of month deviation. *2) Equivalent to 9 seconds of month deviation.

*3) Equivalent to 10 seconds of month deviation. *4) Equivalent to 13 seconds of month deviation.

32.768 kHz-DTCXO Frequency temperature characteristics (Example)





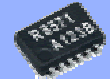
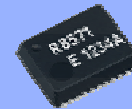
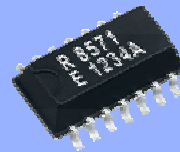
Low current consumption I²C-Bus INTERFACE REAL TIME CLOCK MODULE

RX-8571 SA/NB/LC

- Built-in frequency adjusted 32.768 kHz crystal unit.
- Interface Type : I²C-Bus Interface (400 kHz)
- Operating voltage range : 1.6 V to 5.5 V
- Wide Timekeeper voltage range : 1.3 V to 5.5 V
- Low backup current : 220 nA (Typ.) / 3 V
- 32.768 kHz frequency output function : C-MOS output With Control Pin
- User RAM : 128 bit
- The various functions include full calendar, alarm, timer, etc.
(Long-running timer : 65535 hours)
- * The I²C-Bus is a trademark of NXP Semiconductors



Product Number (Please contact us)
 RX-8571SA : X1B000071xxxx00
 RX-8571NB : X1B000061xxxx00
 RX-8571LC : X1B000051xxxx00



Actual size

RX-8571SA



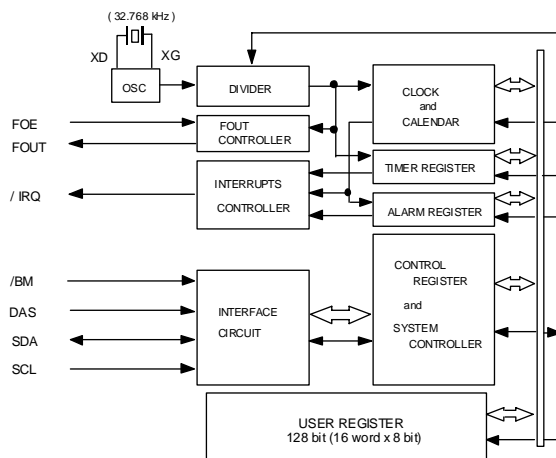
RX-8571NB



RX-8571LC

**NEW**

Block diagram



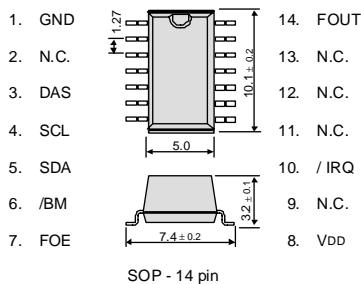
Overview

- 32.768kHz frequency output function
 - FOE pin enable output on/off control.
 - Output frequency can be selected as 32.768kHz, 1024Hz, 1Hz.
- Timer Function
 - Timer function can be set up between 1/4096 second and 65535 minutes.
 - Timing period are 1 hour, 1min, 64Hz, 4096Hz.
 - It is recorded automatic to TF-bit at the time of event occurrence, and possible to output with /IRQ pin output.
- Alarm function
 - Alarm function can be set to day of week, day, hour, or minute.
 - It is recorded automatic to AF-bit at the time of event occurrence, and possible to output with /IRQ pin output.
- Built-in RAM
 - 128 bit (16 word x 8 bit)

Terminal connection / External dimensions

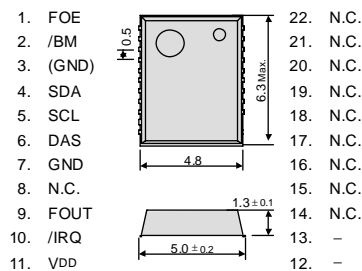
(Unit:mm)

RX - 8571 SA



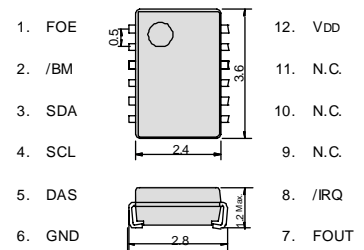
SOP - 14 pin

RX - 8571 NB



SON - 22 pin

RX - 8571 LC



VSOJ - 12pin

Metal may be exposed on the top or bottom of this product. This will not affect any quality, reliability or electrical spec.

Specifications (characteristics)

* Refer to application manual for details.

Recommended Operating Conditions

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Power voltage	VDD	—	1.6	3.0	5.5	V
Clock voltage	VCLK	—	1.3	3.0	5.5	V
Operating temperature	TOPR	—	-40	+25	+85	°C

Frequency characteristics

Item	Symbol	Condition	Rating	Unit
Frequency tolerance	$\Delta f / f$	Ta = +25 °C VDD = 3.0 V	5 ± 23 *	× 10 ⁻⁶
Oscillation start up time	tSTA	Ta = +25 °C VDD = 1.6 V	1 Max.	s

* Please ask for tighter tolerance. (Equivalent to 1 minute of monthly deviation)

Current consumption characteristics

Item	Symbol	Condition	Min.	Typ.	Max.	Unit
Current Consumption	IDD	/BM="L" FOUT=OFF /IRQ = OFF VDD = 3.0V Ta = +25 °C		220	400	nA
		LC type				
		SA/NB type		200	400	
		/BM="L" FOUT=OFF /IRQ = OFF VDD = 3.0V Ta = -40 °C to +85 °C			550	nA



SENSOR

MINIATURE SIZE INCLINED GYRO SENSOR (FOR CAR NAVIGATION SYSTEM)

XV - 8000LK

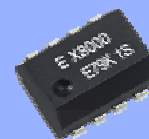
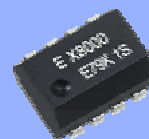
- Small Package size SMD ($6.0 \times 4.8 \times 3.3$ mm)
- Inclined angles: 20 degrees
- 5.0V operable device (Ratio metric output)
- High stability using vibration crystal
- With output terminal of temperature sensor

Recommended Application

- Car navigation system



Product number (please contact us)
X2A000011xxxx00



Actual size



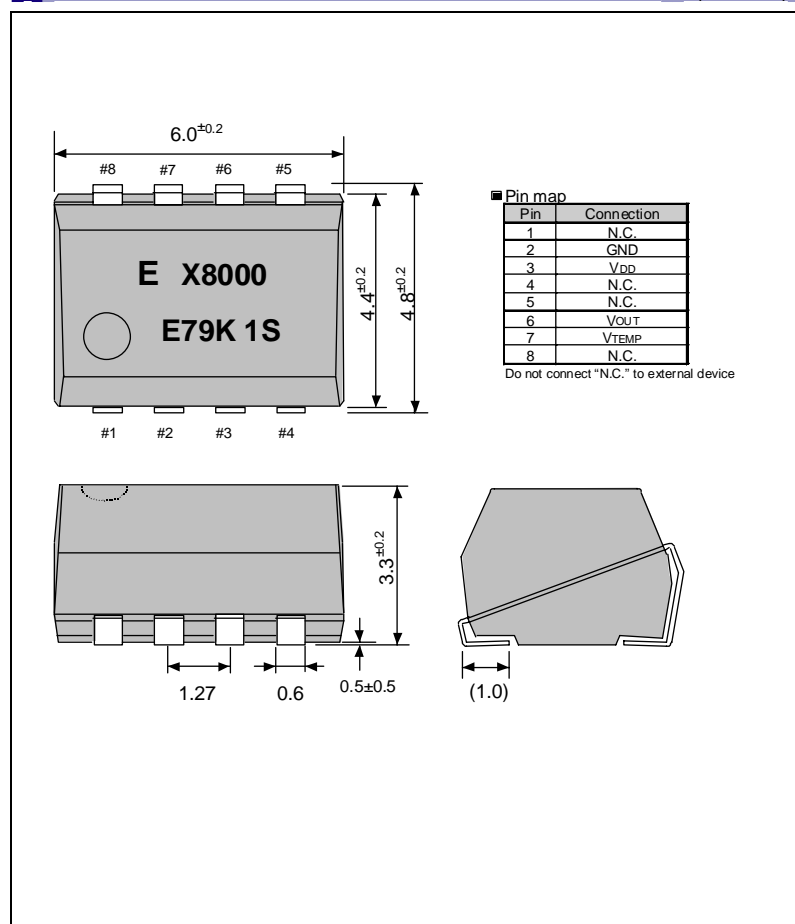
NEW

Specifications (characteristics)

Item	Symbol	Specifications	Remarks
Power source Voltage	Operating Voltage	VDD	5.0 V ± 0.25 V
Temperature range	Storage Temperature	TSTG	-40 °C to +85 °C
	Operating Temperature	TOPR	-40 °C to +85 °C
Scale factor	So	25 mV/deg/s Typ.	
Bias	V ₀	50 % VDD	Ta=+25 °C
Rate range	I	± 60 deg/s	
Non linearity	NI	± 0.5 % FS Max.	Ta=+25 °C
Frequency response	BW	10 Hz Typ.	Phase delay angle 90°
Cross axes	OS	± 5 % Max.	Ta=+25 °C
Current consumption	I _{op}	4 mA Typ.	V ₀ : Output No load condition
Quiescent noise	rN	3 mVp-p Typ	

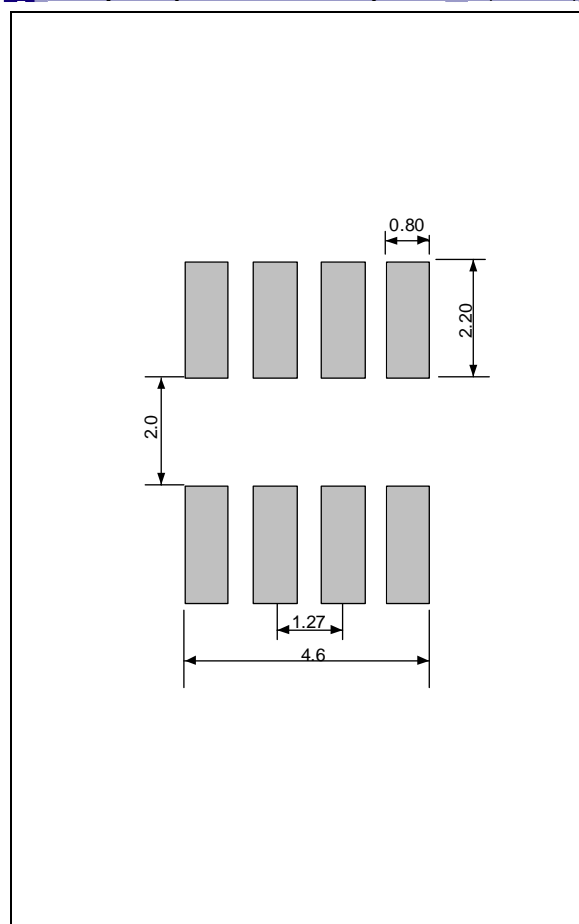
External Dimensions

(Unit:mm)



Footprint (Recommended)

(Unit:mm)





OPTICAL DEVICE

OLPF

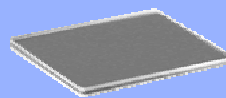
4 points separation / Film type

- For digital single lens reflex camera (DSLR)
- Good separation performance, lighter and thinner

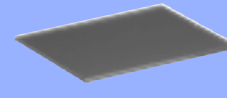
Anti-Dust coat

- Reduce dust adhesion, improve dust removal

Product number (please contact us)
X3Fxxxxxxxxx00



OLPF
4 points separation/Film type



OLPF
Anti-Dust coat

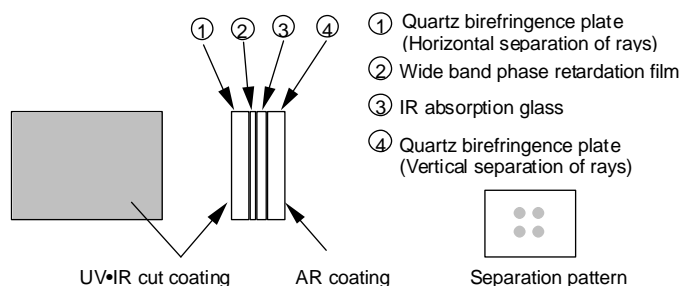
NEW

4 points separation / Film type OLPF

Specifications

Material	Synthetic Quartz, IR glass, Wide band phase retardation film
Wavelength	400 nm ~ 1200 nm
Dimensions(Ex.)	22.0 ^{±0.1} ×28.0 ^{±0.1} (mm)
Accuracy against optical axis(Ex.)	Angle of optical axis (from cutting) () 45° ±1°
	Separation angle () 0° ±1°
UV・IR-cut coat characteristics	UV: 50 % Wavelength : 415 nm ±10 nm IR: 50 % Wavelength : 680 nm ±10 nm
Reflectance of AR coating	1.0 % Max. (Incident Angle 0°, =450 nm~650 nm)

Structure

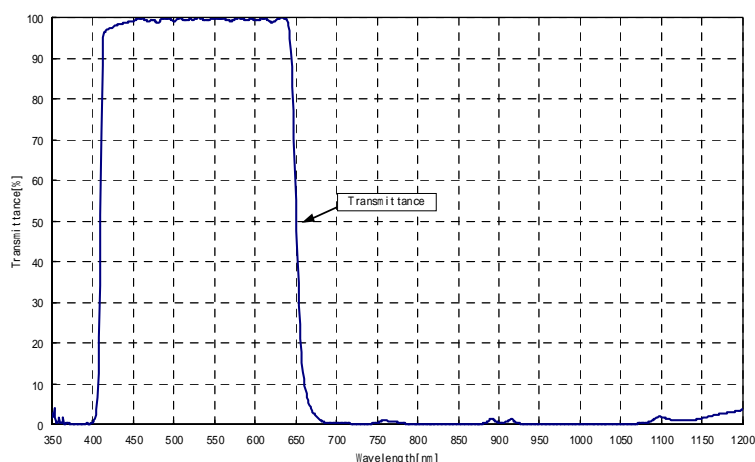


Anti-Dust coat OLPF

Specifications

Material	Synthetic Quartz (Glass)
Wavelength	400 nm~1200 nm
Dimensions(Ex.)	22.0 ^{±0.05} ×28.0 ^{±0.05} (mm)
Accuracy against optical axis	Angle of optical axis (from cutting) () 45° ±1°
	Separation angle () 0° ±1°
UV・IR-cut coat characteristics	UV: 50 % Wavelength : 410 nm ±10 nm IR: 50 % Wavelength : 650 nm ±10 nm
Reflectance of AR coating	1.0 % max. (Incident Angle 0°, =450 nm~650 nm)
Anti-Dust coating side	AR coat side or UVIR coat side
Anti-Dust characteristics	Please inquire

Spectral Characteristics







WORKING FOR EU RoHS / Pb FREE

■EU RoHS / Pb Free Products of Epson Toyocom

The standard product of Epson Toyocom is the goods to be compliant with EU RoHS directive.

We provide the following two kinds of Complies with EU RoHS directive products.

Each mark is displayed on the individual product page as applicable.

	<ul style="list-style-type: none"> ●Pb free. ●Complies with EU RoHS directive.
	<ul style="list-style-type: none"> ●Pb free terminal designed. Contains Pb in products exempted by EU RoHS directive. (Contains Pb in sealing glass, high melting temperature type solder or other.) ●Complies with EU RoHS directive.

■DISTINCTIONS

Distinctions between the product with Pb plating terminals and the product complied with EU RoHS directive.

- Plastic packaged type products.

Marking (year part lot No.) will be changed as follows.

Products with Pb plating terminals (Terminal Plating ; Sn-Pb)	Numeric	1	2	3	4	5	6	7	8	9	0
Products Complied with EU RoHS directive (Terminal Plating ; Sn-Bi or Sn-Ag)	Alphabet	A	B	C	D	E	F	G	H	J	K
Products Complied with EU RoHS directive (Terminal Plating ; Sn)	Alphabet	M	N	R	S	T	U	V	W	X	Z

- Cylinder type products

The color of glass plug will be changed as follows.

Terminal Pb Plating products	Blue or Green etc
Complies with EU RoHS directive products	Gray or White

■Terminal materials of Epson Toyocom products complied with EU RoHS directive

We will deliver the products complied with EU RoHS directive for new order.

Sn plating of terminals is our standard about the products that are two type plating.

	Model	Terminal Material	Terminal Plating	Complies With EU RoHS directive	Pb Free	Remarks (Contains Pb in products exempted by RoHS directive.)	Reference weight (Typ.)
kHz range Crystal units	C-001R	Fe-Ni-Co	Sn-Cu	○	○		148 mg
	C-002RX / C-2-TYPE	Fe-Ni-Co	Sn-Cu	○	○		52 mg
	C-004R/C-4-TYPE	Fe-Ni-Co	Sn-Cu	○	○		30 mg
	C-005R	Fe-Ni-Co	Sn-Cu	○	○		17 mg
	FC-12M	W or Mo	Au	○	○		5 mg
	FC-125	W or Mo	Au	○	○		6 mg
	FC-13E	W	Au	○	○		8 mg
	FC-13F	W	Au	○		Contains Pb in sealing glass exempted by RoHS directive.	8 mg
	FC-135	W	Au	○		Contains Pb in sealing glass exempted by RoHS directive.	11 mg
	FC-145	W	Au	○		Contains Pb in sealing glass exempted by RoHS directive.	15 mg
	FC-255	W	Au	○		Contains Pb in sealing glass exempted by RoHS directive.	22 mg
	MC-146	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	29 mg
	MC-156	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	50 mg
MHz range Crystal units	CA-301	Fe-Ni-Co	Sn-Cu	○	○		172 mg
	FA-128	W	Au	○	○		7 mg
	FA-20H	W	Au	○	○		11 mg
	FA-23A	W	Au	○	○		23 mg
	FA-238V	W	Au	○	○		18 mg
	FA-238	W	Au	○	○		16 mg
	TSX-3225	W	Au	○	○		17 mg
	TSX-4025	W	Au	○	○		24 mg
	TSX-5032	W	Au	○	○		40 mg
	FA-365	W	Au	○		Contains Pb in sealing glass exempted by RoHS directive.	84 mg
	MA-306	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	124 mg
	MA-406	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	330 mg
	MA-505/MA-506	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	505 mg
Resonator	FH-33H	W	Au	○	○		38 mg
	NS-21R	W	Au	○	○		13 mg
	NS-32R	W	Au	○	○		49 mg
	FS-335	W	Au	○	○		56 mg
	FS-555	W	Au	○	○		112 mg
	FS-585	W	Au	○	○		112 mg



	Model	Terminal Material	Terminal Plating	Complies With EU RoHS directive	Pb Free	Remarks (Contains Pb in products exempted by RoHS directive.)	Reference weight (Typ.)
SPXO	SG-150 series	Cu	Au	○	○		9 mg
	SG-211 series	W	Au	○	○		13 mg
	SG-210 series	W	Au	○	○		15 mg
	SG-310 series	W	Au	○	○		26 mg
	SG-550 series	42 Alloy	Sn-Bi	○	○		41 mg
	TCO-710x series	W	Au	○	○		53 mg
	SG-710 series	W	Au	○	○		133 mg
	SG-770 series	W	Au	○	○		166 mg
	TCO-708x series	W	Au	○	○		158 mg
	SG-645 series	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	98 mg
	SG-636 series	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	241 mg
	SG-615 series	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	917 mg
	SG-531 series	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	698 mg
	SG-51 series	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	952 mg
	SG-8003BA	Cu	Au	○	○		9 mg
	SG-8002CE/SG-8003CE	W	Au	○	○		27 mg
	SG-8002LB/SG-8003LB	42 Alloy	Sn-Bi	○	○		41 mg
	SG-8002JF	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	98 mg
	SG-8002CA/SG-8003CA	W	Au	○	○		148 mg
	SG-8002JC	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	234 mg
	SG-8002JA	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	894 mg
	SG-8002DC	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	699 mg
	SG-8002DB	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	942 mg
	SG-8003JF	42 Alloy	Sn or Sn-Bi	○	○		98 mg
	SG-8003JC	42 Alloy	Sn or Sn-Bi	○	○		234 mg
	SG-8003JA	42 Alloy	Sn or Sn-Bi	○	○		894 mg
	SG-8003DC	42 Alloy	Sn or Sn-Bi	○	○		699 mg
	SG-9001LB	42 Alloy	Sn-Bi	○	○		41 mg
	SG-9001CA	W	Au	○	○		155 mg
	SG-9001JC	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	239 mg
	XG-1000CA	W	Au	○	○		126 mg
	XG-1000CB	W	Au	○	○		56 mg
	EG-2021CA series	W	Au	○	○		135 mg
	EG-2001CA series	W	Au	○	○		130 mg
	EG-2002CA series	W	Au	○	○		135 mg
	EG-2121CA series	W	Au	○	○		133 mg
	EG-2102CA series	W	Au	○	○		129 mg
	EG-2101CA series	W	Au	○	○		134 mg
	HG-2150CA series	W	Au	○	○		153 mg
	HG-8002JA series	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	896 mg
	TCO-391J	Sn-P-Cu	Sn or Sn-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	742 mg
	TCO-3100 series	Sn-P-Cu	Sn-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	1018 mg
	MG-5020JE	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	120 mg
	SG-3030LC/3040LC	42 Alloy	Sn or Sn-Ag	○		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	SG-3030JF	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	90 mg
	SG-3030JC/3040JC	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	239 mg
VCXO	VG-4231CE	W	Au	○	○		26 mg
	VG-4231CB	W	Au	○	○		54 mg
	VG-4531CB	W	Au	○	○		53 mg
	VG-4231CA	W	Au	○	○		153 mg
	VG-4501CA	W	Au	○	○		169 mg
	VG-4502CA	W	Au	○	○		164 mg
	VG-4511CA	W	Au	○	○		169 mg
	VG-1201CA	W	Au	○	○		158 mg
	TCO-291J	Sn-P-Cu	Sn	○		Contains Pb in sealing glass exempted by RoHS directive.	742 mg
	TCO-294J	Cu	Au	○		Contains Pb in sealing glass exempted by RoHS directive.	358 mg
	TCO-2152	Ag-Pd	Au	○		Contains Pb in sealing glass exempted by RoHS directive.	152 mg
	TCO-2000 series	Sn-P-Cu	Sn or Sn-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	971 mg
	TCO-2100 series	Sn-P-Cu	Sn or Sn-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	1018 mg
TCXO	TG-3530SA	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	290 mg
	TG-5021BA	xxxxxx	Au	○	○		9 mg
	TG-5005CG	W	Au	○	○		16 mg
	TG-5010CG	W	Au	○	○		16 mg
	TG-5005CE	W	Au	○	○		29 mg
	TG-5010LH	42 Alloy	Sn-Bi	○	○		22 mg
	TCO-5860 series	W	Au	○	○		29 mg
	TCO-5060 / 5160 series	W	Au	○	○		214 mg
OCXO	TCO-6831	Fe-Ni(50 %)	Sn-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	55.5 g
	OX-6500GG	Cu	Au	○		Contains Pb in sealing glass exempted by RoHS directive.	7.0 g
	TCO-6600 series	Fe-Ni(50 %)	Sn-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	27.5 g
	TCO-6730	Fe-Ni(50 %)	Sn-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	82.5 g
	TCO-676 series	Fe-Ni(50 %)	Sn-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	10.0 g
	TCO-679 series	Fe-Ni-Co	Sn-Ag-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	4.5 g
	TCO-6920A	Fe-Ni(50 %)	Sn-Cu	○		Contains Pb in sealing glass exempted by RoHS directive.	91.0 g



	Model	Terminal Material	Terminal Plating	Complies With EU RoHS directive	Pb Free	Remarks (Contains Pb in products exempted by RoHS directive.)	Reference weight (Typ.)
Real Time Clock Module	RX-4045SA	42Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	290 mg
	RX-4045NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	84 mg
	RX-4581NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	84 mg
	RTC-9701JE	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	123 mg
	RTC4701JE	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	120 mg
	RTC-4701NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	83 mg
	RTC-4574SA	42Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	289 mg
	RTC-4574JE	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	118 mg
	RTC-4574NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	83 mg
	RX-4574LC	42 Alloy	Sn or Sn-Ag	○		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RA-4574SA	42Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	289 mg
	RTC-4543SA	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	291 mg
	RTC-4543SB	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	238 mg
	RX-4575LC	42 Alloy	Sn or Sn-Ag	○		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-4571LC	42 Alloy	Sn or Sn-Ag	○		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-4571NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	83 mg
	RX-4571SA	42Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	309 mg
	RA-4565SA	42Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	309 mg
	RX-4801SA	42Alloy	Sn	○		High melting temperature type solder. (Pb85%)	313 mg
	RX-8025SA	42Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	292 mg
	RX-8025NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	84 mg
	RTC-8564JE	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	119 mg
	RTC-8564NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	83 mg
	RX-8564LC	42 Alloy	Sn or Sn-Ag	○		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RA-8565SA	42Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	309 mg
	RX-8571LC	42 Alloy	Sn	○		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-8571NB	Cu Alloy	Sn	○		High melting temperature type solder. (Pb85%)	84 mg
	RX-8571SA	42Alloy	Sn	○		High melting temperature type solder. (Pb85%)	311 mg
	RX-8581SA	42Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	289 mg
	RX-8581JE	42 Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	111 mg
	RX-8581NB	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	84 mg
	RA-8581SA	42Alloy	Sn-Ag	○		High melting temperature type solder. (Pb85%)	289 mg
	RX-8731LC	42 Alloy	Sn or Sn-Ag	○		Contains Pb in sealing glass exempted by RoHS directive.	25 mg
	RX-8801SA	42Alloy	Sn	○		High melting temperature type solder. (Pb85%)	313 mg
	RTC-7301SF	Cu Alloy	Sn or Sn-Ag	○		High melting temperature type solder. (Pb85%)	233 mg
	RTC-7301DG	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	1082 mg
	RTC-62423	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	656 mg
	RTC-72423	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	661 mg
	RTC-62421 / 72421	42 Alloy	Sn or Sn-Bi	○		High melting temperature type solder. (Pb85%)	1090 mg
Crystal Filter (MCF)	HF-232A/233A	W	Au	○	○		16 mg
	HF-362A/363A	W	Au	○	○		25 mg
	HF-372A/373A	W	Au	○	○		42 mg
	HF-734	W	Au	○	○		129 mg
	HF-J14A	W	Au	○			1025 mg
	HF-S14A	W	Au	○			3690 mg
	MF-372A/373A	W	Au	○	○		42 mg
SAW Filter	MF-722A/723A	W	Au	○	○		150 mg
	MF-734A	W	Au	○	○		124 mg
	TF-330A/C	W	Au	○	○		33 mg
	FF-32N	W	Au	○	○		49 mg
	FF-555/FF-585	W	Au	○	○		112 mg
	TQS-570AA-7R	W	Au	○			33 mg
	TQS-566AA-7R	W	Au	○	○		33 mg
	TQS-557AA-7R	W	Au	○	○		34 mg
	TQS-949AD-7G	W	Au	○	○		18 mg
	TQS-471BB-7R	W	Au	○	○		30 mg
Sensor	TQS-477AA-7R	W	Au	○	○		35 mg
	TQS-472BA-7R	W	Au	○			170 mg
	BF-531A	W	Au	○	○		56 mg
	XV-8000LK	42 Alloy	Sn-Ag	○	○		191 mg
	XV-3500CB	W	Au	○	○		65 mg
	XV-8000CB	W	Au	○	○		65 mg
	XV-8100CB	W	Au	○	○		65 mg
	HTS-206	Fe-Ni-Co	Sn-Pb	○		High melting temperature type solder. (Pb85%)	54 mg
	TSU-10GL	Cu	Sn	○		Contains Pb in sealing glass exempted by RoHS directive.	200 g
	TSU-20G	Cu	Sn	○		Contains Pb in sealing glass exempted by RoHS directive.	200 g
	TSU-70G	Cu	Sn	○		Contains Pb in sealing glass exempted by RoHS directive.	200 g
	TSU-100G	Cu	Sn	○		Contains Pb in sealing glass exempted by RoHS directive.	200 g



HANDLING PRECAUTIONS

When using Epson Toyocom products, it is essential to observe the operating conditions specified in their respective specifications or catalogs.

Common points for all products

1. Shock resistance

Epson Toyocom's crystal products are designed to resist physical shocks, but crystal products may be damaged under some conditions, such as dropping from desks or receiving shocks during mounting. Please be sure to re-check the characteristics if product has received any shocks.

2. Soldering heat resistance

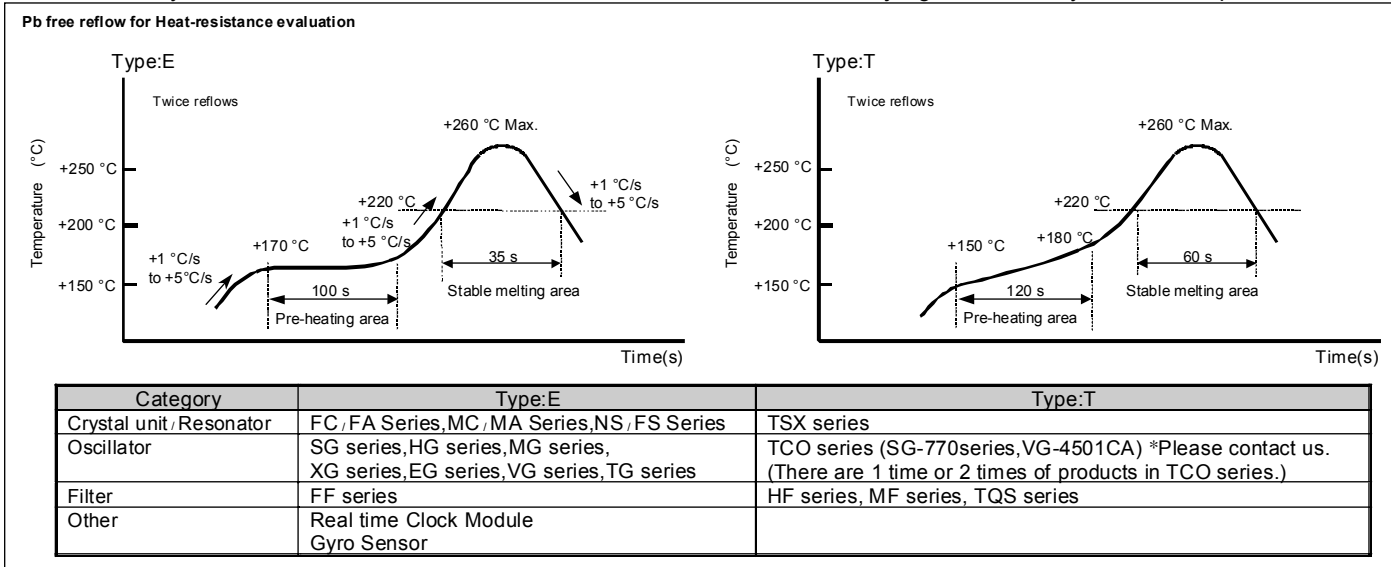
Epson Toyocom's crystal products except SMD products use solder having a $+180^{\circ}\text{C}$ to $+200^{\circ}\text{C}$ melting point. Heating up the package more than $+150^{\circ}\text{C}$ may deteriorate the characteristics or damage the products. If the crystal products need to be soldered at temperature of more than $+150^{\circ}\text{C}$, SMD products are recommended. Using higher temperatures over the following reflow conditions to crystal products, even SMD products, may cause the characteristics to deteriorate. The reflow conditions within following profile is recommended. Always check the soldering temperature and time before mounting these products. Also, please check them again when the mounting conditions are changed. Please contact us for inquiries about heat-resistance if crystal products need to be soldered over the following profile.

(1) Cylinder products and DIP products

Model	Soldering conditions
[Cylinder] C-TYPE, C-2-TYPE, C-4-TYPE, HTS-206	$+280^{\circ}\text{C}$ or under @ Max. 5 s. Do not heat the package at more than $+150^{\circ}\text{C}$.
[Cylinder] CA-301 [DIP] SG-51 / 531, SG-8002DB / DC, RTC-62421 / 72421 / 7301DG	$+260^{\circ}\text{C}$ or under @ Max. 10 s. Do not heat the package at more than $+150^{\circ}\text{C}$.

(2) SMD products Reflow profile (example)

The availability of the heat resistance for reflow conditions of JEDEC-std-020C is judged individually. Please inquire it.



Please make temperature rate as gentle a curve as possible. Also, if the package is cellular, the possibility of cracking is inevitable, so please store it for a short duration and take measures to protect product from dampness when you store it in high humidity.

3. Mounting precautions

Shocks by auto mounting

Shocks caused by auto mounting and vacuuming may deteriorate the characteristics and affect the products. Please set the mounting conditions to minimize the shocks as much as possible, and be sure that there is no affect on the characteristics before mounting. Please review the conditions after the conditions are changed. Also please be sure that crystal products don't hit machines or other electric boards, etc. before or after mounting.

(1) a) Ceramic package products and SON products

Bending the board after soldering ceramic package products and SON products (MC-146, RTC-****NB, RX-****NB) may cause peeling off portions of soldering or package cracks by mechanical stress. Particularly, in the case of cutting boards after soldering these products, please be sure to layout the crystal on a less stressed location and use less stressed cutting method.

b) Ceramic package products

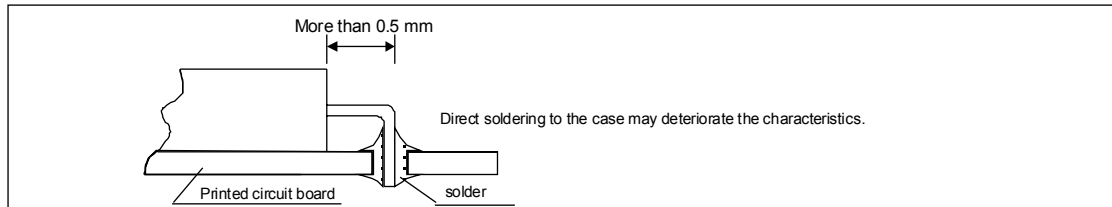
In the case of soldering ceramic package products on a different expansion-coefficient board (ex. Epoxy Glass), soldering crack at the foot pattern would be expected under repeated temperature changes for a long period. Under these conditions, be sure to check the solderability in advance.



(2) Cylinder products

Bending the lead on the glass or pulling the lead strongly may cause cracking of the hermetic seal glass at the root of the lead and may cause the airtightness and the characteristics to deteriorate. When the lead of crystal products need to be bent as in the figure below, leave more than 0.5mm of lead from the case and hold the lead to prevent the lead from cracks. When the lead needs to be repaired, do not pull it, and hold the bent part to correct it. Giving undue pressure on this portion of hermetic seal may cause the airtightness to deteriorate. Please avoid applying pressure. Gluing the case of products on the electric board is recommended to prevent the airtightness from deteriorating.

● Installation example



(3) DIP products

Deformed leads cannot be inserted into board holes. Avoid applying stress sufficient to deform leads.

(4) SOJ Products and SOP products

Please avoid applying stress sufficient to deform the leads.

Deformed leads may cause incorrect soldering.

Particularly SOP products need to be handled with the greatest care.

4. Ultrasonic cleaning

- Products using AT-cut crystal and SAW resonator/filter can be cleaned by ultrasonic. But under some conditions, the crystal characteristics may be affected and internal wiring may be damaged. Please be sure to check the suitability of your system in advance.
- Products using tuning-fork crystals and gyro sensor cannot be guaranteed if cleaned using ultrasonic methods, because crystal may be destroyed.
- Do not wash open-type products.
- With washable products, avoid the use of cleaners or solvents that may negatively affect the product.

5. The affect of mechanical vibration

While there is any given shock or mechanical vibration periodically to crystal products, such as, a piezo sounder, a piezo buzzer, and speaker, to crystal products, output frequency and amplitude can be changed. Especially the quality of telecommunication equipment could be affected by this phenomenon. Although Epson Toyocom's crystal products are designed to minimize the effect of mechanical vibration, Epson Toyocom recommends to check them in advance and then follow the Mounting guidelines as below.

● Mounting guidelines

- (1) Ideally, the mechanical buzzer source should be mounted on a separate PCB from the crystal device.
- (2) It is advisable to use cushion or cutting PCB, if you mount on same PCB.
- (3) Traveling mechanical vibration differs when applied to the PCB only vs. inside the body. Last of all, it is advisable to conform to inside body characteristics.

6. Storage

- (1) Storing the crystal products under higher or lower temperature or high humidity for a long period may affect frequency stability or solderability. Please store the crystal products at the normal temperature and humidity, avoid storing them for a long period and mount them as soon as possible after unpacking.

Normal temperature and humidity:

Temp, +15 °C to +35 °C, humidity 25 % RH to 85 % RH (refer to the standard conditions of test site JIS Z-8703)

- (2) Please carefully handle the inner and outer boxes and reel. External pressure may cause deformation of reel and tape.

7. Radiation

Exposure to radiation can cause deterioration in performance, so avoid irradiation.

8. Chemicals / pH

Do not use or store the product in a pH range that may cause corrosion or dissolution of the materials or packaging.

9. Adhesive

Do not use an adhesive that may cause corrosion of the packing materials, terminals, components, glass materials, and vapor deposited materials used in the products.

(For example, a chlorine-based adhesive may corrode the metal parts "lid" of a crystal unit to diminish the hermetic qualities, lowering the performance.)

10. Halogen Compound

Do not use products in halogen gas. Even a slight amount of halogen gas, such as that found in chlorine gas in the air or in metal parts used in the package, may corrode. Also, do not use any resin that emits halogen gas.



■Crystal unit / Resonator

1. Drive level

Applying excessive drive level to the crystal units may cause deterioration of characteristics or damage. Circuit design must be such as to maintain a proper drive level.(refer to page “Drive level”)

2. Negative resistance

Unless adequate negative resistance is allocated in the oscillation circuit, oscillation or oscillation start up time may increase (refer to page “Allowance for Oscillation”).

3. Load capacitance

Differences in the load capacitance in the oscillation circuit may result in deviations in the oscillation frequency from the desired frequency. Attempting to tune by force may merely cause abnormal oscillation. Before use, please specify the load capacitance of the oscillation circuit.(refer to page “Load capacitance”)

■Crystal Oscillator and real time clock module

All crystal oscillators and real time clock modules are provided with a CMOS IC. Please pay attention to the following points.

1. Static electricity

Although an anti-static-electricity protection circuit is provided in the circuit, excessive levels of static electricity may damage the IC. Choose conductive materials for containers and packing material. Use a soldering gun and a measuring circuit free from high-voltage leakage and provide grounding connection when working with them.

2. Noise

Applying excessive level of extraneous noise to power source or input terminal may cause latch up or spurious phenomenon, which results in malfunction and breakdown.
To maintain stable operation, provide by-pass capacitor with more than 0.1 μ F at a location as near as possible to the power source terminal of the crystal products (between Vcc - GND). Do not permit any objects which emit a high level of noise in a location near the crystal oscillator.

3. Power supply line

Line impedance of a power supply should be as low as possible.

4. Output Load

It is recommended that output load is installed as close as possible to an oscillator (within 20 mm).

5. Treatment of unused input terminals

Unused pins that are left open may collect noise, thereby resulting in malfunction. Also, power consumption may increase when both P-channel and N-channel are turned on, therefore connect unused input terminals to Vcc or GND.

6. Heat impact

Repeated large changes in temperature may degrade the characteristics of a deteriorated crystal unit and cause breakage of wires inside the plastic mold. This must be avoided.

7. Mounting direction

Incorrect mounting of the oscillator may cause malfunction and breakdown, so please check the mounting direction when installing.

8. Power on

It is not recommended to power on from intermediate electric potential and / or extreme fast power on. Powering on under such conditions may cause no oscillation and / or malfunction.

■Optical device

1.Chemicals

Do not use chemicals that may negatively affect the glass materials,vapor deposited materials,or adhesives used in the product.



■ PRECAUTIONS IN DESIGNING OSCILLATION CIRCUITS

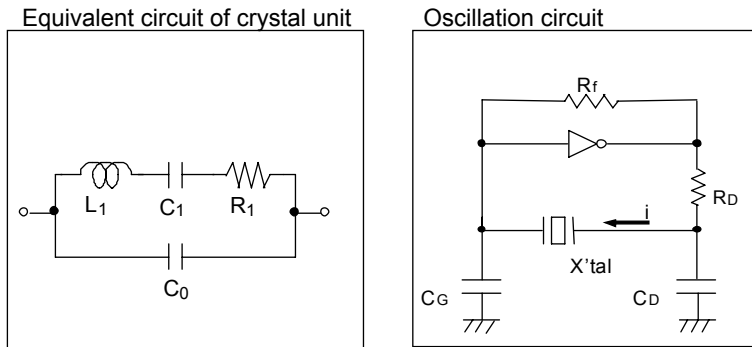
1. Drive level

Drive level denotes electric power required to oscillate a crystal unit, which can be calculated using the following formula.

$$\text{Drive level (P)} = i^2 \cdot R_e$$

Where i stands for current to pass in the crystal unit, R_e for effective resistance of crystal unit, and $R_e = R_1(1 + C_0/C_L)^2$.

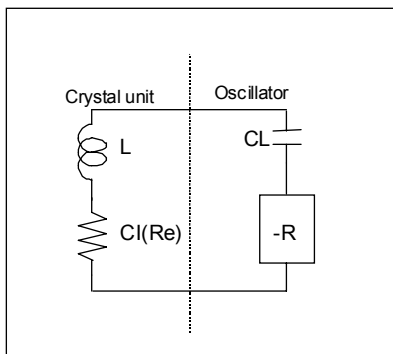
If the Drive level (P) exceeds the specified level, oscillation frequency will shift. This occurs because an excessive level of power causes stress for the crystal and, consequently, temperature rises. If excessive drive level of power is applied to the crystal unit, this may deteriorate or damage the characteristics.



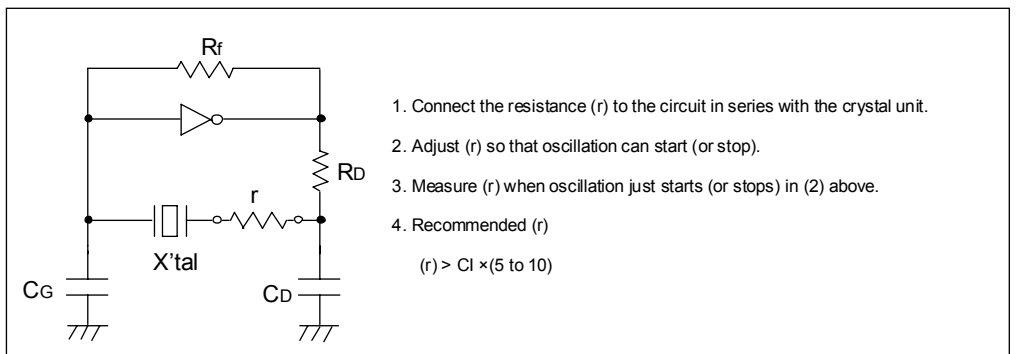
2. Allowance for oscillation

Unless adequate negative resistance is allocated in the oscillation circuit, oscillation start-up time may be increased, or No oscillation may occur. In order to avoid this, provide enough negative resistance in the circuitry design.

● Crystal unit and Oscillator



● Check of Negative resistance

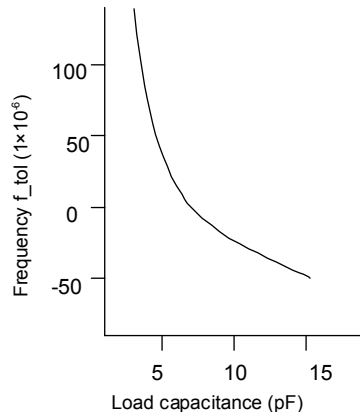


3. Load capacitance

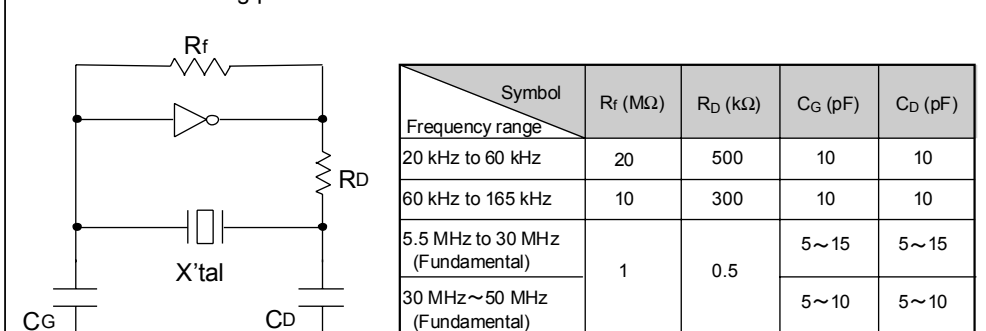
Differences in the load capacitance of the oscillation circuit may result in a different oscillation frequency from the desired one, as shown in the figure below. Approximate expression of the load capacitance of the circuit $CL \cong C_G \times C_D / (C_G + C_D) + C_s$.

Where C_s Stands for stray Capacity of the circuit.

● Frequency and load capacitance characteristics



● Reference for setting parameters of oscillation circuit



IC: equivalent to TC74HCU04 (Unbuffer)

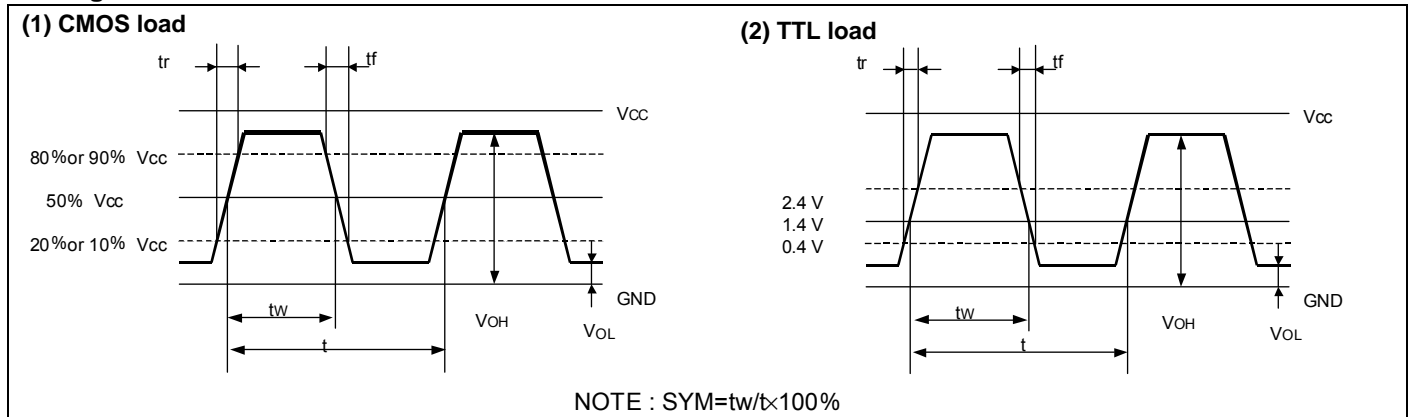
IC: equivalent to TC74VHCU04 (Unbuffer) (30 MHz to 50 MHz)

(TC74HCU04 and TC74VHCU04 are product number of Toshiba Corp.)



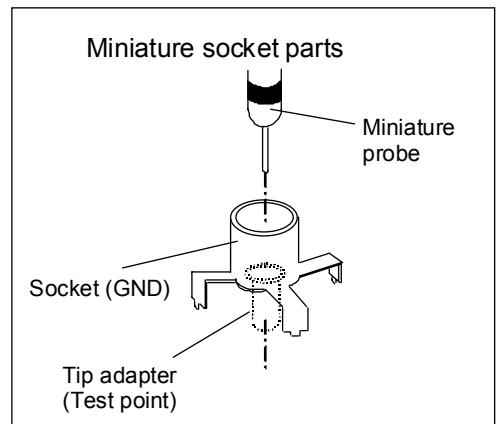
OUTPUT WAVEFORM AND TEST CIRCUIT

1. Timing chart

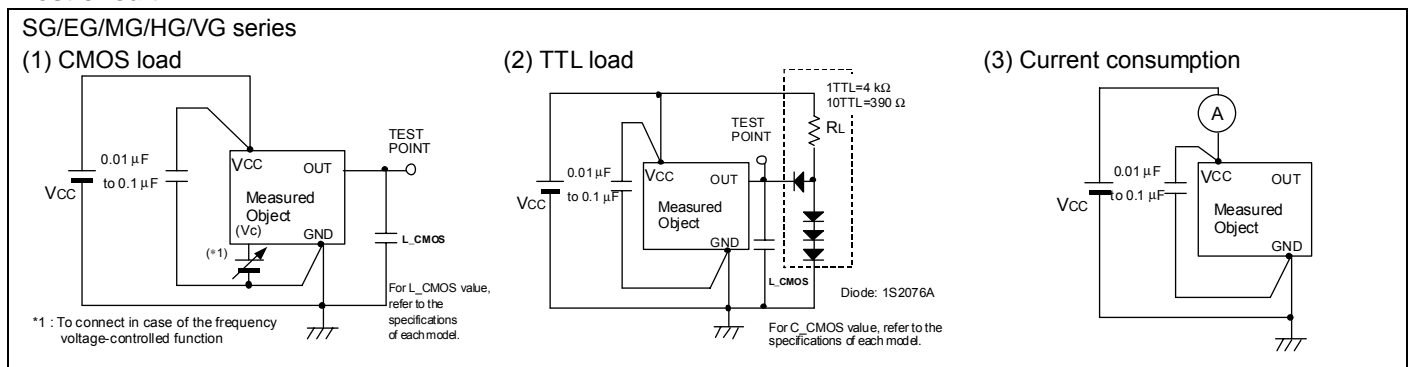


2. Test conditions

- (1) Supply voltage
 - More than 150 μ s until voltage level reaches 90 % from 0 %.
 - Supply voltage impedance is less than 2 Ω of resistance.
- (2) Oscilloscope
 - Input capacitance of less than 15 pF
 - Frequency range of 5 times or more of measurements frequency.
 - Earth lead of the probe should be as short as possible.
 - Probe impedance when measuring frequency is to be more than 1 M Ω . Simultaneous measurement is possible as the wave form passes from the amplifier stage of an oscilloscope.
- (3) MISCELLANEOUS
 - CL includes the probe capacitance.
 - Ammeter with small internal impedance should be used.
 - To observe wave form, please use a miniature socket.
 - (do not use a long ground wire of the probe.)



3. Test circuit



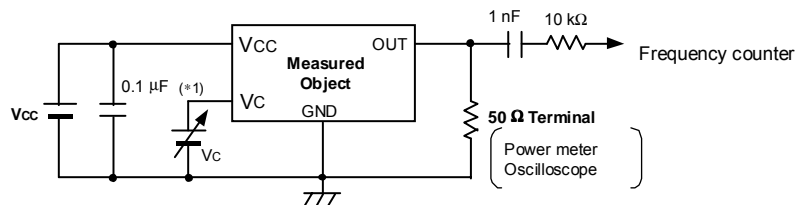
TCO-****series

*1 : To connect in case of the frequency voltage-controlled function

(1) 50 Ω load

Model:

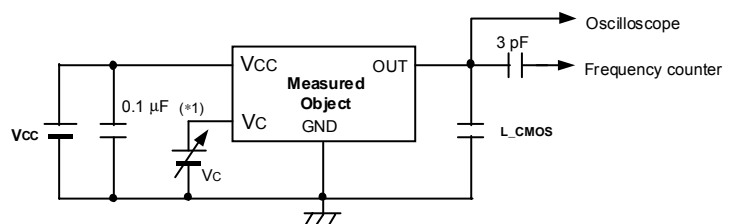
TCO-294J
TCO-6920A
TCO-291J
TCO-391J



(2) CMOS load-1

Model:

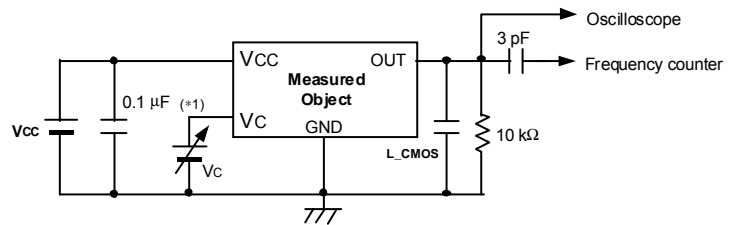
TCO-2003A	TCO-7116X1Z4
TCO-2004A	VG-4501CA
TCO-2103A	TCO-710x series
TCO-2104A	TCO-5060/5160 series
TCO-2107	TCO-708*X1A series





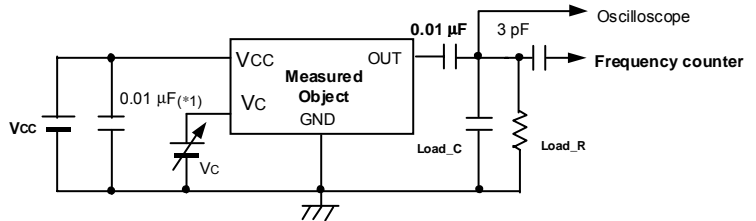
(3) CMOS load-2

Model:
TCO-6602
TCO-676
TCO-679



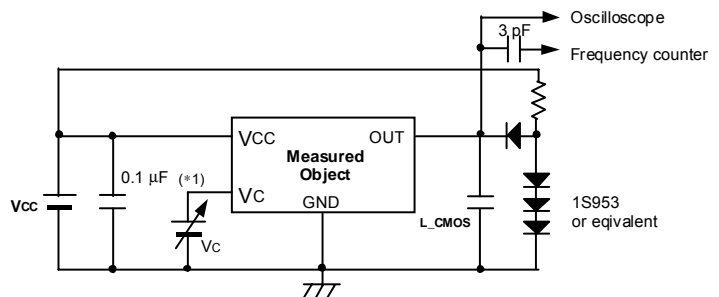
(4) Resistance, Capacity load

Model:
TCO-5860 series
TG-5010CG
TG-5010LH
TG-5005CE
TG-5005CG
TG-5021BA



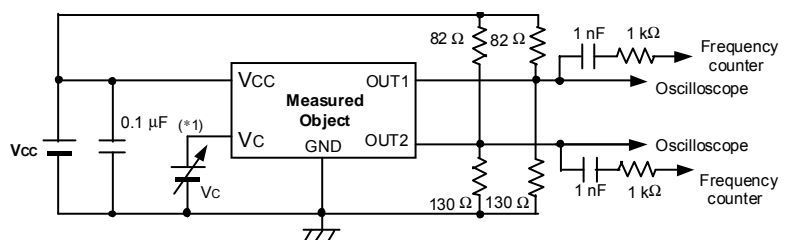
(5) TTL load

Model:
TCO-2001A
TCO-2002A
TCO-2101A
TCO-2102A
TCO-2106
TCO-6730
TCO-708*A1A series



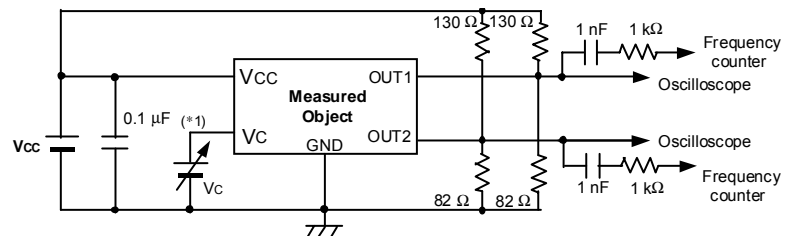
(6) PECL load

Model:
TCO-2112
TCO-3112



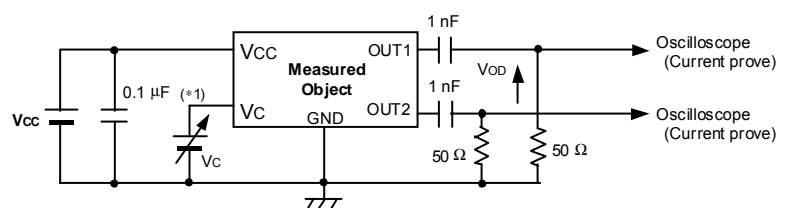
(7) LV-PECL load

Model:
TCO-2111
TCO-2131
TCO-2152
TCO-3111
TCO-3131



(8) LVDS load

Model:
TCO-2114
TCO-3114





STANDARD PACKING SPECIFICATIONS

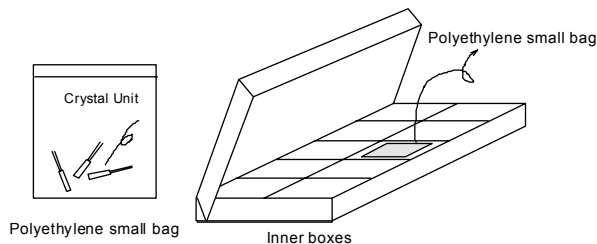
For SMD products, standard packing quantity is specified as below table. Please order in accordance with packing quantity.

1. Cylinder

Cylinder products are packed in vinyl bags per lot of 250 to 1000 pcs.

From 1 to 20 bags are then placed in inner boxes to make a lot.

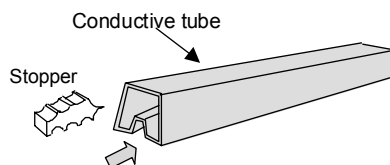
Inner boxes are then placed in cartons for shipment. (the quantity varies with the model.)



Model	Quantity
C-001R	250 pcs / vinyl bags
C-2-TYPE C-4-TYPE C-002RX C-004R C-005R CA-301	500 pcs / vinyl bags

2. DIP

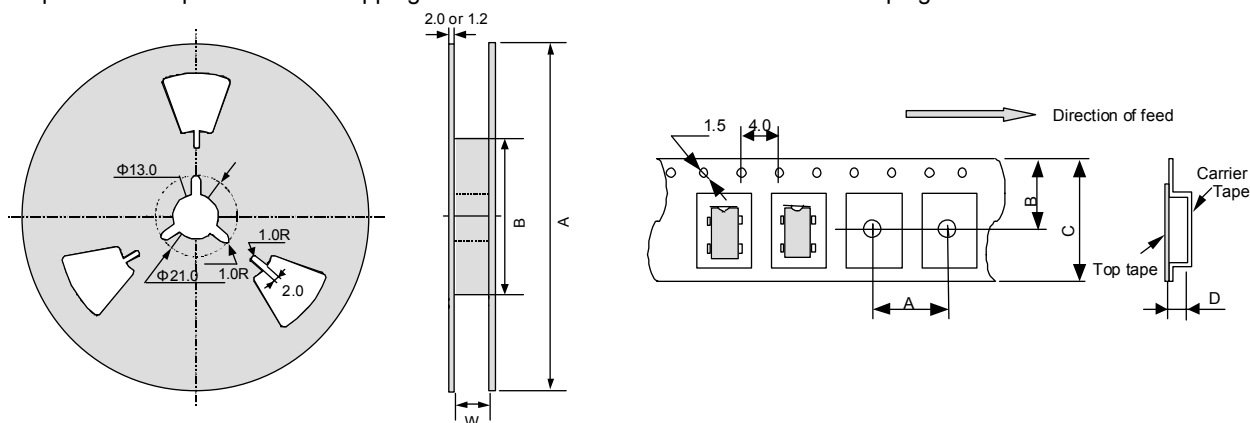
DIP products are placed into antistatic IC tubes and packed into boxes for shipment.



Model	Quantity
SG-531 SG-8002/8003DC	35 pcs / tube
SG-51 SG-8002DB RTC-62421 RTC-72421 RTC-7301DG	25 pcs / tube

3. SMD

SMD products are packed in the shipping carton as below table in accordance with taping standards EIA-481 and IEC-60286 .



STANDARD PACKING QUANTITY and dimension (Unit:mm)

●Crystal Unit / Resonator

Model	Quantity (pcs/Reel)	Reel dimension			Career Tape dimension				Direction of feed (L=left direction)
		A	B	W	A	B	C	D	
FC-12M	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	0.75	L
FC-125	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	0.75	L
FC-13E	3000	Φ180	Φ60	13.0	4.0	7.25	12.0	0.7	L
FC-13F	3000	Φ180	Φ60	13.0	4.0	7.25	12.0	0.7	L
FC-135	3000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.0	L
FC-145	3000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.0	L
FC-255	3000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	1.1	L
MC-146	3000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	1.7	L
MC-156	3000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	1.65	L
FA-128	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	0.7	L
FA-20H	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	0.75	L
TSX-3225	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.0	L
FA-238V / 238 / 23A	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.05	L
TSX-4025	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	0.9	L
TSX-5032	2000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.0	L
FA-365	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.6	L
MC-306/30A	3000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	2.7	L
MC-405/406	1000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	3.8	L
MA-306	3000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	2.7	L
MA-406	1000	Φ330	Φ80 or Φ100	25.5	12.0	13.25	24.0	4.0	L
MA-505/506	1000	Φ330	Φ80 or Φ100	25.5	12.0	13.25	24.0	4.8	L
FH-33H	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.35	L
NS-21R	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.15	Individual regulations
NS-32R	4000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	1.52	R
FS-335	4000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	1.52	R
FS-555	4000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	2.0	R
FS-585	4000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	2.0	R



●Crystal Oscillator

Model	Quantity (pcs/reel)	Reel dimension			Career Tape dimension				Direction of feed (L=left direction)
		A	B	W	A	B	C	D	
SG-3030/3040JC	1000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	3.3	L
SG-3030JF	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
SG-3030/3040LC	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.45	L
SG-150 series	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	0.95	L
SG-645 series	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
SG-636 series	1000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	3.0	L
SG-615 series	1000	Φ330	Φ80 or Φ100	25.5	12.0	13.25	24.0	4.8	L
SG-210 series	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.15	L
SG-211 series	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.15	L
SG-310 series	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.4	L
TCO-710x series	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.4	L
SG-710 series	2000	Φ254	Φ80	17.5	8.0	9.25	16.0	2.5	L
SG-770 SCD	1000	Φ180	Φ60	17.0	8.0	9.25	16.0	2.1	L
TCO-708x series	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.1	L
SG-8003BA	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	0.95	L
SG-8002CE/SG-8003CE	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.4	L
SG-8002LB/SG-8003LB	2000	Φ254	Φ100	13.4	8.0	7.50	12.0	1.4	L
SG-8002JF/SG-8003JF	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
SG-8002CA/SG-8003CA	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
SG-8002JC/SG-8003JC	1000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	3.3	L
SG-8002JA/SG-8003JA	1000	Φ330	Φ80 or Φ100	25.5	12.0	13.25	24.0	4.8	L
SG-9001LB	2000	Φ254	Φ100	13.4	8.0	7.50	12.0	1.4	L
SG-9001CA	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
SG-9001JC	1000	Φ330	Φ80 or Φ100	17.5	8.0	9.25	16.0	3.3	L
XG-1000CA	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
XG-1000CB	2000	Φ254	Φ100	13.4	8.0	7.25	12.0	1.95	L
EG-2000 series	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
HG-2150CA	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
HG-8002JA	1000	Φ330	Φ80 or Φ100	25.5	12.0	13.25	24.0	4.8	L
TCO-391J	1000	Φ330	Φ80	25.5	16.0	13.25	24.0	4.2	L
TCO-3100 series	700	Φ330	Φ80	25.5	16.0	13.25	24.0	5.4	L
MG-5020JE	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.0	L

●VCXO

VG-4231CE	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.4	L
VG-4231CB	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.4	L
VG-4531CB	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.4	L
TCO-7106X1Z4	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.4	L
VG-4231CA	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
VG-4501CA	1000	Φ180	Φ60	17.0	8.0	9.25	16.0	2.1	L
VG-4502CA	1000	Φ180	Φ60	17.0	8.0	9.25	16.0	2.1	L
VG-4511CA	1000	Φ180	Φ60	17.0	8.0	9.25	16.0	2.1	L
VG-1201CA	1000	Φ254	Φ100	17.5	8.0	9.25	16.0	2.3	L
TCO-291J	1000	Φ330	Φ80	25.5	16.0	13.25	24.0	4.2	L
TCO-294J	500	Φ330	Φ80	25.5	12.0	13.25	24.0	2.8	L
TCO-2152	1000	Φ180	Φ60	19.4	8.0	9.25	16.0	2.2	L
TCO-2000/2100 series	700	Φ330	Φ80	25.5	16.0	13.25	24.0	5.4	L

●TCXO

TG-3530SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
TG-5021BA	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	0.95	L
TG-5005CG	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.15	L
TG-5010CG	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.15	L
TG-5005CE	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.4	L
TG-5010LH	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.4	L
TCO-5860 series	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.4	L
TCO-5060/5160 series	1000	Φ180	Φ60	17.5	8.0	9.25	16.0	2.2	L



● Real time clock module

Model	Quantity (pcs/reel)	Reel dimension			Career Tape dimension				Direction of feed (L=left direction)
		A	B	W	A	B	C	D	
RX-4045SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-4045NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RX-4581NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RA-4565SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-4801SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RTC-9701JE	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.0	L
RTC-4701JE	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.0	L
RTC-4701NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RTC-4574SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RTC-4574JE	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.0	L
RTC-4574NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RX-4574LC	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.45	L
RA-4574SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RTC-4543SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RTC-4543SB	1000	Φ330	Φ80 or Φ100	24.4	12.0	11.50	24.0	2.5	L
RX-4575LC	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.45	L
RX-4571LC	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.45	L
RX-4571NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RX-4571SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-8025SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-8025NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RTC-8564JE	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.0	L
RTC-8564NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RX-8564LC	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.45	L
RA-8565SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-8571LC	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.45	L
RX-8571NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RX-8571SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-8581SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-8581JE	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.0	L
RX-8581NB	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	1.8	L
RA-8581SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RX-8731LC	2000	Φ180	Φ60	13.0	4.0	7.25	12.0	1.45	L
RX-8801SA	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	3.65	L
RTC-7301SF	1000	Φ330	Φ80 or Φ100	17.5	12.0	9.25	16.0	2.4	L
RTC-62423	1000	Φ330	Φ80 or Φ100	25.5	16.0	13.25	24.0	2.95	L
RTC-72423	1000	Φ330	Φ80 or Φ100	25.5	16.0	13.25	24.0	2.95	L

● Monolithic Crystal Filter

HF-232A/ HF-233A	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.15	L
HF-362A/ HF-363A	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.5	L
HF-372A/ HF-373A	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.35	L
HF-734A	1000	Φ180	Φ60	17.0	8.0	9.25	16.0	1.8	L
HF-J14A	1000	Φ330	Φ80	25.5	16.0	13.25	24.0	4.0	L
HF-S14A	400	Φ330	Φ100	45.5	24.0	21.95	44.0	5.4	L
MF-372A/ MF-373A	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.35	L
MF-722A/ MF-723A	1000	Φ180	Φ60	17.0	8.0	9.25	16.0	1.8	L
MF-734A	1000	Φ180	Φ60	17.0	8.0	9.25	16.0	1.8	L

● SAW Filter

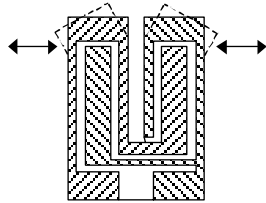
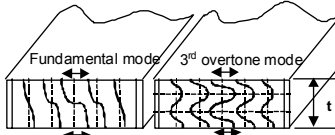

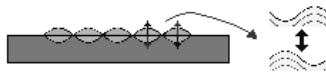
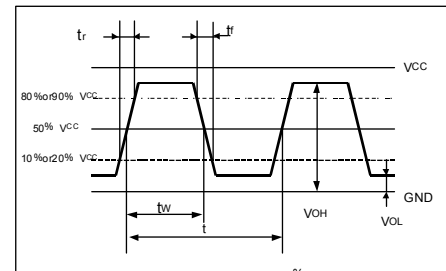
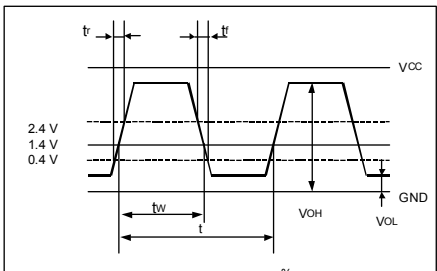
FF-555	4000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	2.0	R
FF-585	4000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	2.0	R
FF-32N	4000	Φ330	Φ80 or Φ100	13.5	8.0	7.25	12.0	1.52	R
TF-330A/C	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.5	Individual regulations
TQS-570AA-7R	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.5	Individual regulations
TQS-566AA-7R	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.5	Individual regulations
TQS-557AA-7R	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.5	Individual regulations
TQS-949AD-7G	3000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.5	Individual regulations
TQS-471BB-7R	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.5	Individual regulations
TQS-477AA-7R	2000	Φ180	Φ60	9.0	4.0	5.25	8.0	1.5	Individual regulations
TQS-472BA-7R	1000	Φ180	Φ60	17.0	12.0	9.25	16.0	1.9	L
BF-531A	1000	Φ180	Φ60	13.0	8.0	7.25	12.0	1.4	Individual regulations

● Gyro Sensor

XV-3500CB	2000	Φ254	Φ100	13.4	8.0	7.25	12.0	2.1	L
XV-8000CB	2000	Φ254	Φ100	13.4	8.0	7.25	12.0	2.1	L
XV-8100CB	2000	Φ254	Φ100	13.4	8.0	7.25	12.0	2.1	L
XV-8000LK	1000	Φ254	Φ100	13.4	8.0	7.25	12.0	3.7	L



Glossary

Item	Content	Object
Fundamental mode	<p>First harmonic crystal vibration mode. The AT resonance frequency is determined by the thickness of the crystal, but even with the same thickness the third overtone will be about three times the frequency of the fundamental. With tuning fork crystal unit, the second overtone is about six times the fundamental.</p> <div>  <p>Tuning fork crystal unit Fundamental mode</p>  <p>AT-cut crystal unit $F(\text{MHz}) = \frac{1670}{t(\mu\text{m})} \quad (t: \text{Thickness})$ Fundamental mode 3rd overtone mode </p>  <p>SAW Resonator</p>  <p>Vibration mode</p> <p>SAW Structure figure Output Frequency $f = k/\lambda$ (λ=Interval of an/the electrode, k= Fixed number)</p> </div>	X'tal ,OSC
Divided frequency	The output frequency that is divided by the internal IC.	OSC
Symmetry (tw/t) (SYM)	<p>Ratio of full and half cycles. For CMOS loading duty is rated at 1/2 V_{CC}, and for TTL loading at 1.4V.</p> <div>  <p>CMOS loading</p> <p>NOTE : SYM=tw/t × 100%</p>  <p>TTL loading</p> <p>NOTE : SYM=tw/t × 100%</p> </div>	OSC
(Equivalent)series capacitance (C ₁) (motional capacitance)	Energy distortion to the (equivalent) internal charge capacitance component of the crystal unit, at the series resonant frequency.	X'tal
(Equivalent)series resonant resistance (R ₁)	Vibration loss to the (equivalent) internal charge capacitance component of the crystal unit, at the series resonant frequency. A measure of the easiness of oscillation.	X'tal
Drive level (DL)	Current or voltage level in the oscillating (operating)state.(Drive power= power required to oscillate crystal unit.)	X'tal
Deviation in PB	The difference between the max. and min. attenuations within a pass band.	Filter
Frequency (f)	Number of waves (cycles)per second. The relation between frequency and cycle is $f(\text{Hz})=1/t(\text{s})$.	ALL
(Frequency)aging (f _{age} , f _{aging})	Amount of frequency drift when operated under the specified conditions for a specified term.	ALL
Frequency tolerance precision (f _{tol})	Under specified conditions at an ambient temperature of +25 °C,the difference in actual (measured) frequency from the nominal frequency.	X'tal
Frequency voltage Coefficient	Taking the output frequency at the central voltage in the operating voltage range as the reference, the change in output frequency to voltage. Causes of this change are changes in crystal deformation, and changes in IC internal constants for chips mounted in the oscillator and Real time clock module. The effects of the ICs are larger.	OSC
Frequency tolerance (f _{tol})	Within standard temperature and operational voltage ranges, the drift in the output frequency. The output frequency drift including frequency temperature characteristics and frequency voltage characteristics. When there is an annotation in the margin, It is given to priority.	OSC
HFF-XTAL	HFF-XTAL is a high frequency fundamental mode crystal unit using inverted-mesa shape AT-cut blank fabricated with photolithographic technology. Therefore it has an excellent stability for temperature, aging and shock.	OSC

X'tal:Crystal unit, OSC:Crystal oscillator

More details available on Epson Toyocom website.



Item	Content	Object
Frequency temperature characteristics	<p>Taking the frequency at 25 degrees Centigrade as the reference, the change in frequency in response to ambient temperature.</p> <ul style="list-style-type: none"> ● Tuning fork crystal unit. SAW Resonator. $\Delta f/f = B(T_i - \theta X)^2$ $\theta X: \text{specified temperature}$ ● AT crystal unit. $\Delta f/f = \alpha(\theta X - 25) + \beta(\theta X - 25)^2 + \chi(\theta X - 25)^3$ <p>Examples of frequency temperature characteristics</p> <div> </div>	ALL
Group delay distortion (Δt)	The difference between the max. and min. group delay within a pass band B1 unless otherwise specified.	Filter
Insulation resistance (IR)	Resistance between lead and lead, or between lead and case package.(conductive package)	ALL
Insertion loss (L)	The logarithmic ratio of the power delivered to the load impedance before insertion of the filter to the power delivered to the load impedance after insertion of the filter.	Filter
Load capacitance (C _L)	Effective capacitance (series equivalent charge capacitance) of the oscillation circuit as seen from the pins of the crystal unit. This capacitance is determined as a condition when the crystal unit is connected to the oscillation circuit and will determine the output frequency. Load capacitance approximation:C _L	X'tal
Max.drive level (GL)	Rating for the drive level. Current or power input over this level may result in characteristic degradation or destruction.	X'tal
Max. supply voltage (V _{CC} -GND)	Maximum rated value for power input to the power supply pin. Input over this value may result in characteristic degradation or destruction.	OSC
Max. input level (R)	The max. power that can be delivered to the filter without destructing the filter.	Filter
Nominal frequency (f _{nom})	Nominal value of frequency of crystal unit. A frequency given in specification, to which other frequencies may be referred.	X'tal Filter
Operating temperature Range(T _{use})	Temperature range where specification characteristics are fulfilled,unless otherwise specified.	ALL
Origin frequency (f _o)	Oscillation source frequency of oscillator inside oscillation system.	OSC
Fall time(t _f)	The time it takes for the output wave form to change from the high voltage(high level) to the low voltage(low level). Also called wave form fall time. See waveform diagram under Symmetry.	OSC
Rise time(t _r)	The time it takes for the output wave form to change from the low voltage (low level) to the high voltage (high level). Also called wave form fall time. See wave from diagram under Symmetry.	OSC
Oscillation circuit	<p>Circuit needed to oscillate crystal unit. Circuit Constants will differ with type of crystal unit and frequency.</p> <p>Basic oscillation circuit using CMOS IC</p>	X'tal

X'tal:Crystal Unit, OSC:Crystal Oscillator

More details available on Epson Toyocom website.



Item	Content	Object
Start-up time (t _{str})	The time from power on until the wave form stabilizes. However, voltage rise times depend on the power supply. Therefore, the time depends on the power supply, and the time is measured from a specific set of initial conditions.	OSC
Output enable(OE)	Output is switched to high impedance, and wired OR connection can be used to select multiple outputs(frequency). OE pin: High or open. Specified frequency output = enabled. OE pin: Low. Output is high impedance=disabled. Oscillation is not stopped, so after the clock is disabled, it is not synchronized with OE (clock is continuous).	OSC
	● Timing 	
Output frequency (f _o)	The frequency output from the oscillator circuit or the crystal oscillator system.	OSC
Output load conditions	The types and quantities (power) of the loads that can be connected to the oscillator. Calculated for 1 TTL as I _{OH} = -40 μA, I _{OL} = 1.6 mA and for LS-TTL as I _{OH} = -20 μA, I _{OL} = 0.4 mA.	OSC
Overtone	Vibration state when crystal is vibrating as a high harmonic(see base wavelength). It is harder to match the overtone oscillation circuit with the crystal unit than the fundamental oscillation circuit.	X'tal,OSC
Pass band (BW)	Pass band (BW) A band of frequencies B1 in which the attenuation is equal to or less than a specified value A1 A band of frequencies B1 in which the attenuation is equal to or less than the insertion loss L. Stop band attenuation Bands of frequencies B2 and B3 in which the attenuations are equal to or greater than specified values A2 and A3 respectively.	Filter
Ripple (R)	The difference between the max. and min. peak attenuation within a pass band.	Filter
Recommended drive level (DL)	Excitation level for optimum oscillation characteristics.	X'tal
Shunt capacitance(Co)	Charge capacitance between the two electrodes in the crystal unit.	X'tal
Soldering conditions (T _{SOL})	Temperatures or times over these limits may result in characteristic degradation or destruction.	ALL
Stand-by (\overline{ST})	Function that halts crystal unit oscillation and frequency Division. Cuts the current consumed by the oscillators circuit and the frequency division stage. \overline{ST} pin-high or open: Specified frequency output. \overline{ST} pin-low: Output is low level,oscillation stops. : Output is low level (weak pull-down), oscillation stops. : Output is high impedance, oscillation stops. Please refer to each data sheet.	OSC
	● Timing 	
Shortage temperature Range(T _{stg})	Maximum absolute rating for the discharged state (no input of voltage, current or power). Exposure to temperatures over this level may result in characteristic degradation or destruction. To assure precision, store at room temperature whenever possible.	ALL
Spurious response A4 (dB)	Min. attenuation caused by extraordinary response in the stop band. Spurious response usually appears at a higher frequency than the center frequency.	Filter
Supply voltage (V _{CC})	Voltage input to V _{CC} pin which will support continuous operation with specification characteristics.	OSC
Terminating impedance (Z _t)	Either of the impedances presented to the filter by the source or by the load. (R _t : Resistive portion, C _t : Parallel capacitive portion including stray capacitance)	Filter
VSWR	Voltage Standing Wave Ratio	Filter

X'tal:Crystal Unit, OSC:Crystal Oscillator

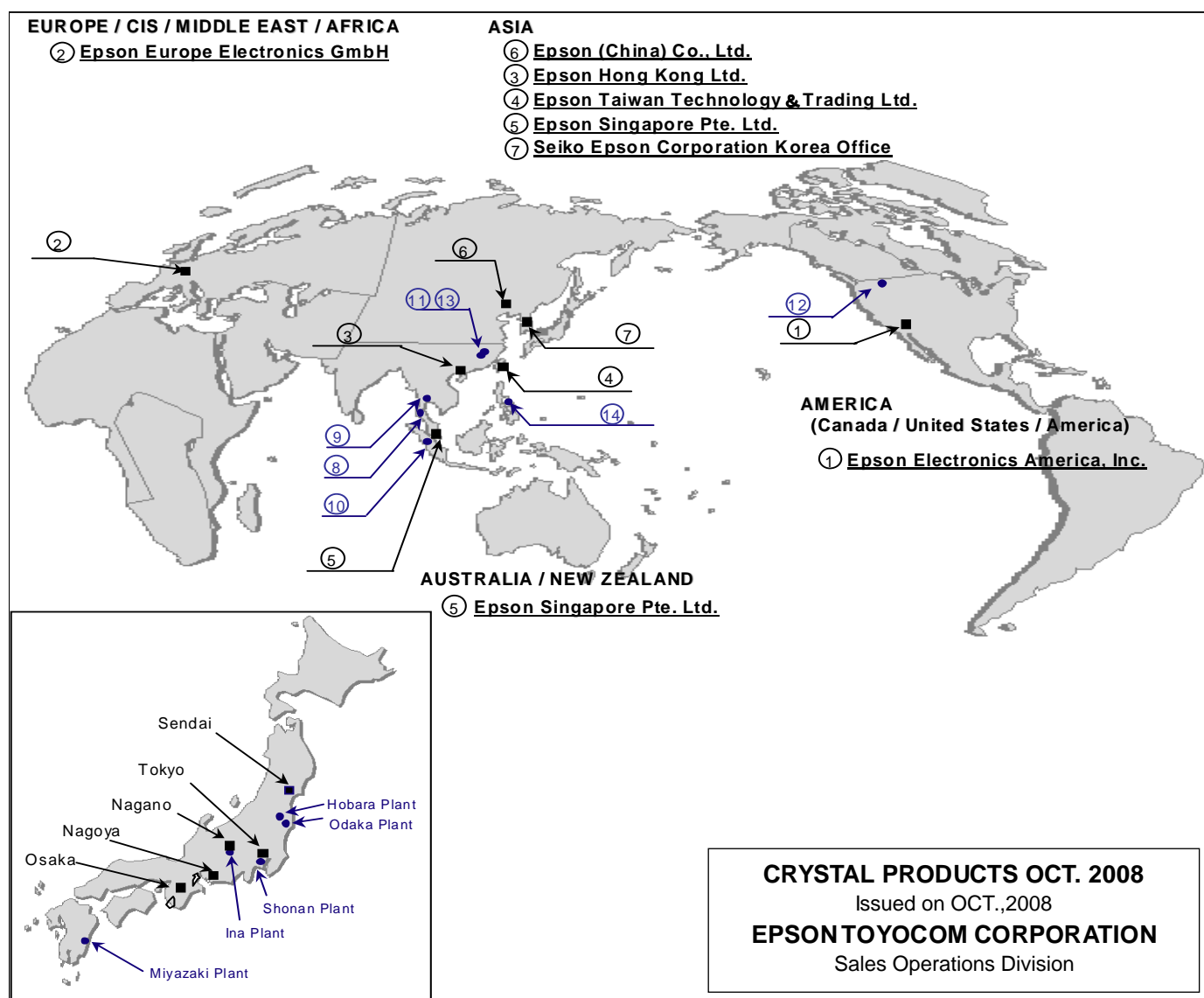
More details available on Epson Toyocom website.

Manufacturing Plant

Plant	Date Operations Commenced	Products
Ina Plant	Jun.1959	Crystal unit Crystal oscillator Real time clock module Surface acoustic wave device Sensing device Optical device
Shonan Plant	Jun.1963	—
Hobara Plant	Nov.1972	Crystal unit Crystal oscillator Module
Odaka Plant	Jan.1977	Crystal unit Surface acoustic wave device Monolithic crystal filter
Miyazaki Plant	Jun.1984	Synthetic quartz Crystal oscillator Optical device

Plant	Date Operations Commenced	Products
: Epson Toyocom Malaysia Sdn.Bhd.	Dec.1974	Crystal unit Crystal oscillator Real time clock module
: Epson Toyocom (Thailand) LTD.	May.1988	Optical device
: PT.Epson Toyocom Indonesia	Apr.1996	Crystal unit Crystal oscillator
: Epson Toyocom Suzhou CO.,LTD.	Mar.1997	Crystal unit Crystal oscillator Real time clock module
: Epson Toyocom Seattle, Inc.	Jun.2000	Synthetic quartz
: Epson Toyocom (Wuxi)CO.,LTD.	Jul.2001	Crystal unit Optical device
: Epson Precision (Philippines) Inc.	Feb.2002	Crystal unit

Business area



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